FLIGHT

and The AIRCRAFT ENGINEER

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The Outlook

"Blue Tape"

IN the *Daily Telegraph* of July 8 is published a letter from the works manager of a firm entrusted with a contract for the manufacture of parachute supply droppers. Although requested on May 29 to produce these articles as a most urgent requirement, no doubt for provisioning and munitioning troops in France, even after 29 days the first dropper had not been accepted. As this was June 28, there was then no need to make them for work in France.

The works manager claims that the delay was due, in the first place, to the unnecessarily close limits on the dimensions of what is not a machined product. Taking this up with the Air Ministry, he obtained concessions to redesign certain fittings, to paint instead of anodise, and to use stock materials of steel and aluminium. But after production had started, the first visit by the A.I.D. revealed that the Ministry's concessions had not been passed on to the inspectors. The inspectors—probably in accordance with their instructions and therefore quite rightly—said that A.I.D. release notes must be produced for all the raw materials used. The result of the ensuing correspondence has already been stated, and readers will have listened to the broadcast of the heroic tragedy of the defence of Calais—how, when the Lysanders arrived with their parachute supply droppers in response to the defender's request for food, munitions and even water, the battle was over. "The British do not surrender," said the commander. . . .

Flight stands four-square behind the principle of rigid compliance with the high standard of aircraft manufacture adopted in this country. High standard means close limits on dimensions and also minute inspection, of which the A.I.D. release note is evidence, of all materials used in those parts of the aeroplane failure of which would involve the safety of the machine or detract from its effectiveness as a weapon of war. To adopt any lower standard would probably lose the war for us, and we do not believe that Germany is working to any lower standard. But at such a time of extreme national urgency as the present—and one wonders if even these words are adequate for the occasion—such standards should not be adhered to for non-stressed parts and such components as do not affect the functional fighting ability of the aeroplane. The A.I.D. men must be given more personal responsibility and allowed to use their judgment, but only, we repeat, on the less vital parts and components. Such a change in procedure would add to the effectiveness of the national "going to it."

Mass Mine-Laying

THE extent of the mines laid by the R.A.F. along the coast occupied by the Germans and in the Baltic is positively amazing, and one wonders how many flying hours were involved in the original laying, to say nothing of replacing those which the Germans may have swept. The work, it should be noted, was done by the Bomber Command. That, in itself, is a startling fact. Day after day we have read with astonishment of the continuous series of raids which the Bomber Command has been sending against all sorts of military objectives in territory held by the enemy, and some of us have wondered whether some of the squadrons might not be getting overworked and stale. Yet all the time this other work was going quietly on without anybody saying a word about it. Obviously the Bomber Command has now a good many more squadrons at its disposal than it had when the war started. The great drive in the aircraft industry, for which the Chief of the Air Staff published his thanks the other day, is having a notable effect.

At the same time the Coastal Command and the Fleet Air Arm, both doubtless stronger than they were nine months ago, have been giving yeoman aid to the Bomber Command. The Hudson is now almost ranked among our bombers, and regularly attacks targets on

land as well as bombing such U-boats as it sights. The Fleet Air Arm of late has not confined its activities to spotting, reconnaissance and occasional fighting. It has been dive-bombing with great success and with a determination which has been marked by the loss of some gallant crews.

The Action at Oran

THE Government's action in dealing with the French Navy at Oran and elsewhere is a matter of historic moment, but not primarily of aeronautical interest, and it is hardly for *Flight* to comment on it.

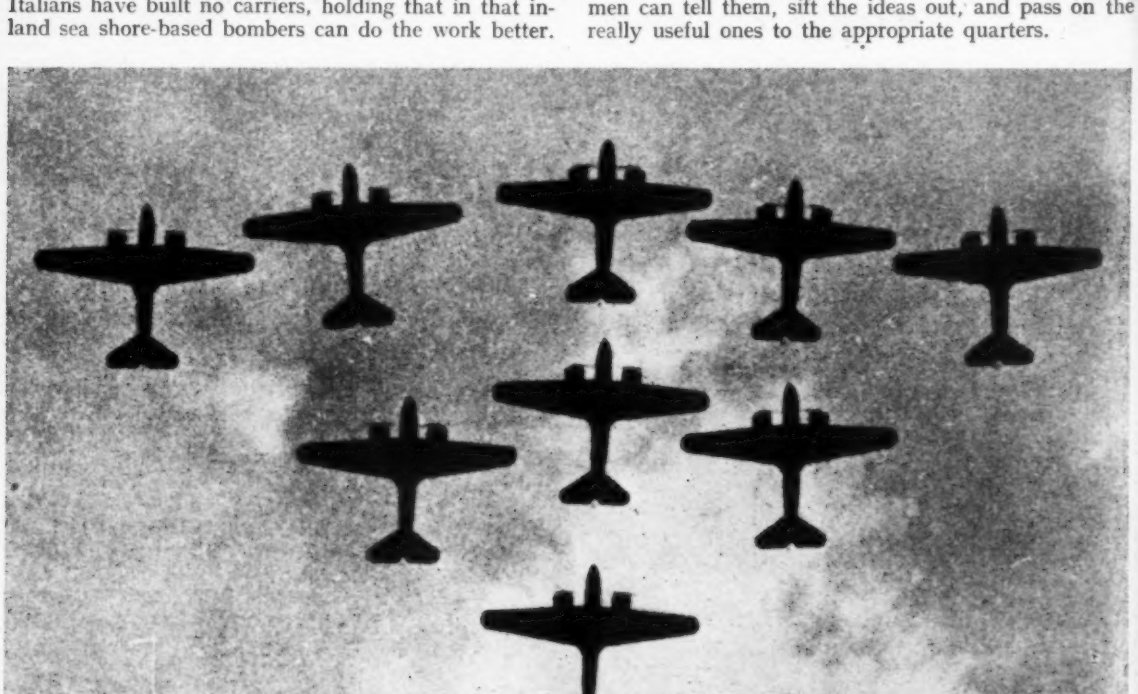
There is aeronautical interest, none the less, in one detail of the action at Oran. The formidable French battle cruiser *Strasbourg* escaped from the harbour and made off for Toulon, where she would undoubtedly fall into the hands of the enemy. It was important to take steps to prevent this. With due foresight, the Admiralty had sent the *Ark Royal* with Vice-Admiral Somerville's force, and she despatched some of her T.S.R. aircraft after the *Strasbourg*. At least one torpedo got home, and that will deny the use of the ship to the enemy for months to come. We have lost two large aircraft carriers, perhaps more, in this war, and naturally some people have been asking if such vulnerable ships are worth while. That one torpedo may be a sufficient answer to the question. Aircraft-borne torpedoes have not figured much in the naval fighting so far, but that one may have an important bearing on coming operations.

Since then we have been told of aircraft of the Fleet Air Arm being very active in the Mediterranean. The Italians have built no carriers, holding that in that inland sea shore-based bombers can do the work better. Their theory has a good deal in it, but none the less we are just now finding ship-borne aircraft very useful in those waters.

Pooling Experience

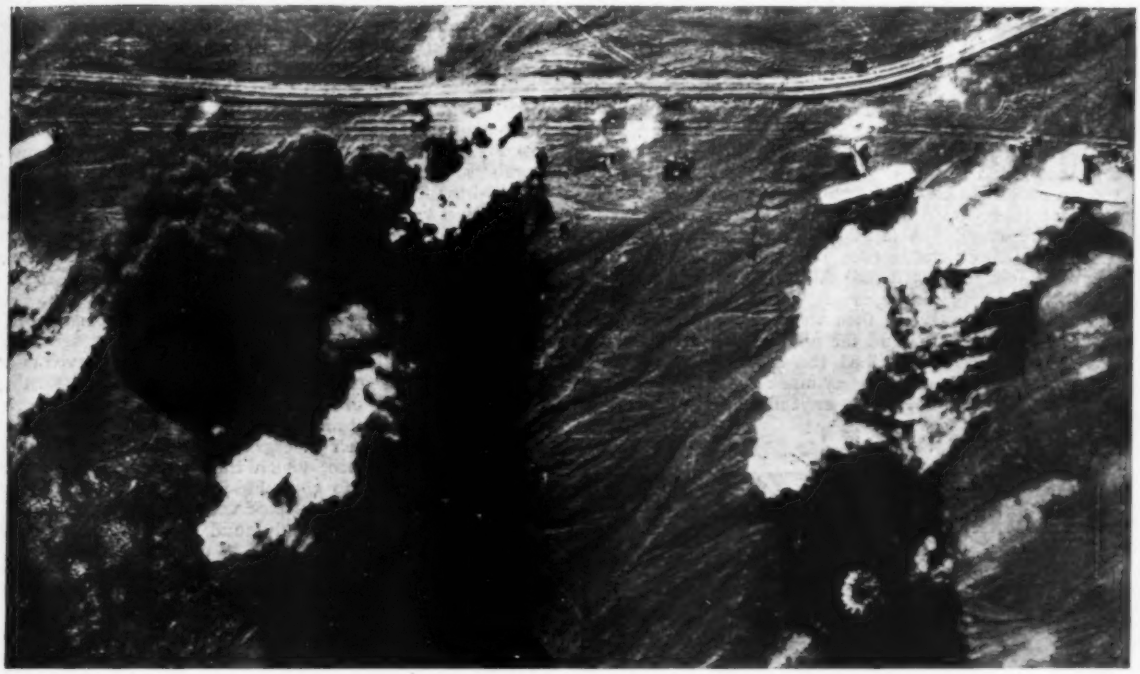
SIR ARCHIBALD SINCLAIR has marked his régime at the Air Ministry by making two new appointments, one a new Member of the Air Council to deal with all training matters, and the other a committee over which Sir Robert Brooke-Popham will preside to collect the experiences of officers and airmen who have been in action against the enemy and hear their ideas as to the best ways of "biffing the Boche." That bit of graphic slang dates from the last war, and the appointment of Sir Robert reminds us that, in some ways at least, we are correcting mistakes of the last war. In the last war a pilot, as soon as he had reached the stage now represented by leaving an elementary school to enter a F.T.S., was usually sent to France to learn all the rest of his business in the face of the enemy or die in the attempt. Now at the F.T.S. he passes first through the Intermediate Flying Squadron, then through the Advanced Flying Squadron, and after leaving the school, complete with "wings" and thoroughly versed in navigation, bombing, firing, fighting and all the rest of it, he is sent to an operational training unit where he is given a final polish.

But to be under fire teaches many things which no school can teach, and now, as twenty-four years ago, the clever pilot or air gunner finds out things for himself. Sometimes they are useful, sometimes not so useful. The Brooke-Popham Committee will hear all that the fighting men can tell them, sift the ideas out, and pass on the really useful ones to the appropriate quarters.



PRETTY, BUT—: This issue contains the first reasonably detailed description of the Italian Savoia-Marchetti S.M.85 single-seater, twin-engined dive-bomber. In addition to the above æsthetically attractive view of a formation of these machines, other pictures appear on pages *d* and 25. The S.M.85, although interesting as an offensive weapon, would stand little chance against a Hurricane, Spitfire, or Defiant, or, for that matter, against a Skua, Roc or Gladiator.

WAR in the AIR



Not bad for amateurs : Thirteen Capronis on fire after an R.A.F. attack on an Italian East African aerodrome. The Italian radio the other evening referred to the R.A.F. as "that amateur air force."

The "Scharnhorst" Bombed at Kiel : The Oran Action : More Petty Raids on Britain

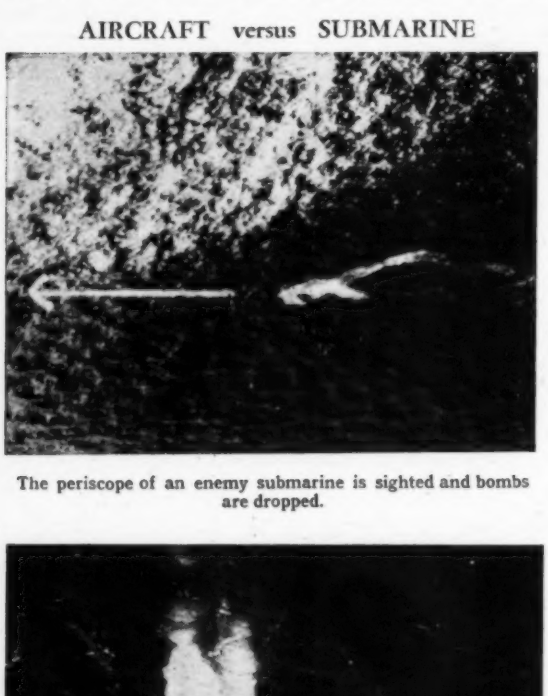
A NUMBER of striking events have taken place since our last issue. Notable among them have been a daring raid on Kiel, the capture or destruction of a large part of the French Navy, and the torpedoing of the *Arandora Star*. The R.A.F. or the Fleet Air Arm played a part in all of them. In addition, the series of heavy British attacks on German bases, communications, and oil stores on the Continent have continued unabated, while each night and most evenings German bombers in varying numbers have crossed our coasts and dropped bombs. In the war against Italy we have continued to score small but heartening successes, and that enemy's great number of U-boats is shrinking at a rate which has not yet quite reached the figure of one a week.

A fortnight ago we recorded that the German battleship *Scharnhorst*, which has a normal displacement of 26,000 tons and a main armament of nine 11in. guns besides secondary armament, was bombed by the Fleet Air Arm while in Norway after sinking H.M. aircraft carrier *Glorious*, and on her way home for repairs was hit by a torpedo fired by a British submarine and was again bombed by the Coastal Command. She was taken to the base at Kiel at the east end of the famous canal and there was placed in a floating dock. But the R.A.F. had not done with her. The Bomber Command took up the work, and on the night of Monday, July 1, a strong force of our bombers made their way to Kiel. Excellent visibility enabled the raiders to trace their route from the mouth of the Eider River right up to the Naval Base at Kiel, which was easily located without the need of assistance from parachute flares. The first aircraft approached the target at a considerable height and then, with engines throttled back, glided down to launch its attack. The first bomb scored a direct hit on the floating dock, about a third of the way along its length, and was quickly followed by others which burst among buildings on the quayside. "Just when we were half-way through our glide," said the pilot of this aircraft, "the enemy put up a searchlight which swept the sky and, having failed to locate us, went out. We saw our first bomb burst with a terrific explosion on the dock, and almost at the same instant every gun in the district seemed to go into action. The barrage was too hot for us to wait and see what damage we had done, but we did turn round and notice that a fire we had started on the quayside was getting bigger and bigger." The following raiders, coming in to attack in rapid succession, were met with a continuous barrage of fire from pom-pom batteries and guns of heavy calibre. One aircraft, pressing home its attack through a screen of bursting shells, was repeatedly hit. "I expected the tail turret to fall off, but, luckily, it didn't," remarked the rear gunner of this aircraft, whose wireless operator reported that "the whole of the interior of the fuselage was lit up by the flashes of the shells bursting around him." The aircraft reached its objective and the pilot dropping his bombs on the dockyard saw a series of heavy explosions, followed within a few minutes by a huge outbreak of fire, which was still visible when the crew of the crippled raider were 85 miles away on their homeward journey. For nearly an hour the battleship and the dockyard were continuously attacked by successive units of the strong raiding force. Four direct hits on the *Scharnhorst* and on the dock were claimed by one aircraft; another, gliding down to within 2,000ft. of the dock, dropped three of its heaviest bombs, which burst in a row across the battleship and started fires on the ship and on the edge of the dock. "The A.A. fire came uncomfortably close," said the pilot of this aircraft, "but as we were not hit I made a second run. In the

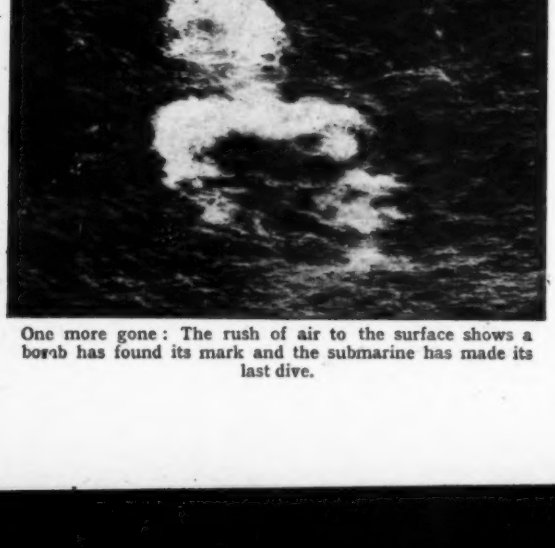
WAR IN THE AIR (CONTINUED)

first I was a bit off the target and did not drop any bombs. I could see the *Scharnhorst* perfectly, a grey ship in a square frame, as we came over the second time. We definitely scored hits and were so excited that we circled round for some time before leaving." A few minutes later the floating dock was again hit by a salvo of bombs and the pilot of this aircraft, circling the target to observe the result of his attack, saw five large fires break out. The crew of a closely following aircraft which claimed six hits on the dock reported that these fires so lit up the target that they could distinctly see the silver structure and gun turrets of the *Scharnhorst*. Other aircraft, meanwhile, were attacking naval buildings and storehouses on either side of the canal. A large building to the north of the docks was struck and set on fire, and another big shed was so completely gutted that the steel girders of its framework were plainly visible among a mass of flames to the raiders overhead. Large fires were also started in other parts of the dockyard, and the pilot of the last aircraft to leave the Kiel area described the largest of these as "a solid mass of flame covering as much space as a big aerodrome." "I have never seen anything like it," he added.

AIRCRAFT versus SUBMARINE



The periscope of an enemy submarine is sighted and bombs are dropped.



One more gone: The rush of air to the surface shows a bomb has found its mark and the submarine has made its last dive.

"Three other quayside fires which would normally look quite big appeared almost insignificant beside that great inferno."

The well-known steamer *Arandora Star*, in which many people have made joyous cruises to the Mediterranean, to Norway, and elsewhere, was torpedoed by a German U-boat some miles off the North-West Coast of Ireland. At the time she was carrying large numbers of German and Italian internees to Canada, doubtless to put them in a place safe from the attentions of their own countries' bombers. The Germans among them were heard to curse the U-boat loudly and deeply, and they also disgraced themselves by the frantic way in which they fought for places in the lifeboats. Consequently the greatest loss of life occurred among the Italian internees, who on the whole were less muscular than the "Aryans." Every Italian has not the physique of Primo Carnera. The *Arandora Star* was found sinking by a Sunderland flying boat of the Coastal Command. The captain of the aircraft saw scattered about on the water 13 lifeboats full of survivors as well as survivors on rafts and others clinging to floating debris. The crew of the Sunderland, circling low, immediately dropped first-aid outfits, all the food they had on board, including their emergency rations, and all their cigarettes and tobacco, which they placed in waterproof bags and attached to their life-jackets to act as buoys. Having seen the survivors pick these up the aircraft went in search of assistance and found a destroyer, which it guided to the scene. It was 11 o'clock in the morning when the *Arandora Star* was first sighted, and it was three hours later when the destroyer arrived and began to pick up the survivors. In this work the Sunderland assisted by indicating the position of small groups on rafts and others supporting themselves on wreckage, by dropping smoke flares and firing Verey lights to indicate the positions. Another destroyer subsequently came on the scene, and by just after 4 p.m. all the survivors had been picked up.

Dealing with the French Fleet

EVER since the Government of Marshal Pétain capitulated to the Germans and signed the Armistice terms which included the surrender of the French Fleet, the whole world has been on tenterhooks to know what would happen. It happened on Wednesday, July 3, and next day the Prime Minister told the House of Commons about it. The story is now known to all the world. It is a melancholy tale, which Mr. Churchill said that he recounted "with sincere sorrow." It is terrible to think that we had to shed French blood, when such a short time ago the two Navies were fighting side by side in great harmony, and the seamen of both were fraternising on shore. We must console ourselves with the thought that by preventing the fine French Fleet from falling into the hands of the common enemy we have done the best thing possible in the circumstances towards freeing France from her oppressor and restoring her to her proper position as a great Power. We cannot, at the same time, refrain from a feeling of pride at the efficiency of our squadron at Oran, which achieved its purpose in a ten-minutes engagement without loss to itself.

Among the French vessels which were destroyed at Oran was the seaplane carrier *Commandant Teste*, which would have been of little value to us. One French battle cruiser, probably the *Strasbourg*, but perhaps her sister ship the *Dunkerque* (both of those ships not long ago were joining with us in the hunt for the *Admiral Graf Spee*), managed to slip out of Oran harbour and made off with the intention of obeying her orders and placing herself at the disposal of the Germans. These two ships are among the finest of their class in the world, mounting eight 13-inch guns besides secondary armament, and it was important that neither should be added to the strength of the Axis Powers. So the Fleet Air Arm was sent in pursuit (the *Ark Royal* was with Vice-Admiral Somerville's force), and the French ship was hit by at least one torpedo. The Prime

WAR IN THE AIR (CONTINUED)

Minister remarked, "She will at any rate be out of action for many months to come."

A part of Mr. Churchill's speech which aroused indignation in the House concerned the release by the Bordeaux Government of 400 German pilot prisoners. Many of them, perhaps most of them, he said, had been shot down by the Royal Air Force. M. Reynaud, the former patriotic Premier of France, had promised that these pilots should be handed over to the British, but when he fell from power the Bordeaux Government handed them back to Germany, "with the sure knowledge," said Mr. Churchill, "that they would be used to bomb this country and thus force our airmen to shoot them down for the second time over." He also said that the German Air Force already feels acutely the shortage of high-grade pilots. We may add our hope that men who have once fallen victims to Hurricanes will be circumspect next time they meet them. Parachute jumping is not likely to be a popular pastime in the *Luftwaffe*, and those who have twice met Hurricanes are not always in good fettle for jumping of any sort.

Pinprick Raids on Britain

IN the period June 23 to July 4 the R.A.F. destroyed forty German aircraft and lost 30 themselves, but it must be remembered that the R.A.F. have been taking higher risks than the Germans have been doing. Never have they slackened off from their determined raids by night and sometimes by day on military objectives in Germany and in the countries occupied by Germans. On the other hand the German raids on Great Britain have on many occasions been tip-and-run affairs in which the airmen seemed more intent on escaping from our fighters than on doing serious damage. That, however, may have been deliberate policy. On Tuesday, July 2, they raided this country during the evening and during the night, but in a random fashion. They killed 12 civilians and injured 123, mostly not very seriously. Wednesday, 3rd, was a busy day. The Germans started coming in during the afternoon over Scotland, over the North-East coast of England, Suffolk, and the South East. They did not get away unscathed, for seven bombers were shot down by Spitfires and Hurricanes. Six more were severely damaged. In Great Britain six were killed and 78 injured. On Thursday, 4th, the Germans approached the Channel ports and at Portland a naval auxiliary vessel was hit and set on fire, while one small tug and a lighter were sunk. Another raider penetrated into the South-Western counties.

Air Marshal Sir Philip Joubert de la Ferté broadcast a statement on air-raid warnings on July 3, in the course of which he said:—

"The issuing of air-raid warnings in accordance with the above policy is carried out by the Commander-in-Chief, Fighter Command, Royal Air Force, who decides whether a warning is to be put out. The medium through which these warnings are made available to the public is Home Security, a department of the Home Office.

"The general principle which has guided the Government up to the present has been that unless there is a very clear indication, either in the numbers of aircraft detected or from other information received, that an actual bomb attack is developing, no public warning is to be put out. Now, however, the Germans have started seriously to drop bombs in this country. It is immediately obvious that a decision has to be taken wherein the disturbance to the national life, and in particular to its sleep, by the "take cover" signal is balanced against the risks to individuals and to industry that is involved in not broadcasting raid warnings. Any decision to hold up the raid warnings, even when there is some indication of impending bomb attack, cannot be taken without putting the people of this country fully into the picture.

"This is what the Government are now doing. They are asking you to realise that if from to-day a raid warning was given for every enemy aircraft that crossed our coasts the industrial life of the country would be most gravely interfered with and there would be a severe strain on the patience and on the nervous system of the people as a whole. We therefore ask you to believe that whenever there is good reason to suppose that a serious bomb attack involving real danger to life as well as to property is impending, then we shall give you due warning.

"On the other hand, there will be many occasions on which the Commander-in-Chief, Fighter Command, in the exercise of his judgment, will withhold the raid warning. Sometimes he may be wrong, and in consequence lives may be lost and people suffer injury. We ask you to trust us and to believe that the issue of these warnings is a matter of the most serious concern to highly responsible and well-trained individuals and that we shall not ask you to run risks which are not justified by the general war situation.

"To sum up, we are fighting a national war. If it is to be brought to a successful conclusion the wheels of industry must continue to turn so as to provide the fighting men with essential arms. If no risks at all are to be run by the civil population, then the fighting men will not get their arms and we may lose the war. It seems, therefore, fair to ask you to run some risk so that the greater gain may come to the nation as a whole."

German bombers continued to cross our coasts most nights and many evenings, but the damage which they did was slight, and the casualties were not heavy. Our fighters took regular toll of the raiders, and the A.A. guns had their share of successes. The casualties among the civil population have not been as heavy as had been feared, and the actual damage done has been slight. None the less, we are braced to face worse things.

On the other hand, the R.A.F. continues to attack important objectives in the enemy countries. The docks at Kiel, Wilhelmshaven, Cuxhaven, Hamburg and Brunsbüttel were bombed again during the night of Friday, July 5, and during the week-end.

Shipping Attacked

ON Friday, July 5, the Bomber Command and the Coastal Command made raids on enemy shipping off the Dutch coast soon after noon. The bombers took the ships by surprise, dived on to them and hit a large German supply ship. Earlier in the morning a Hudson had dropped a bomb by the side of a Flak (i.e., anti-aircraft) ship in the same waters, and turned the vessel completely upside down.

Within five days last month our aircraft attacked five U-boats in the North Sea and dropped bombs which certainly scored hits and may well have destroyed the submarines.

There have been a few air raids on Gibraltar which have done no damage. The Pétain Government has stated that they sent two naval squadrons to bomb the Rock in revenge for the action which we had taken at Oran. This deplorable action proved futile. The Fleet Air Arm has dropped bombs on the *Dunkerque*, which had gone aground near Oran and had been evacuated by her crew. Italian raids on Malta continue, causing casualties but very little damage. Some Italian bombers have been shot down there.

On Thursday, July 4, our fighters of the Middle East Command shot down seven Italian fighters out of nine which they met, and two other Italian aircraft as well. The squadron of nine was overwhelmed by a force of only six British machines. One of our men was forced to land. The Libyan port of Tobruk has been successfully bombed again by the R.A.F. and the F.A.A. Other units of the F.A.A. have attacked the aerodrome of Catania, in Sicily.

R.A.F. bombers have carried out a gigantic task in laying mines in the Baltic, off the coast of Norway, and off the harbours of the Low Countries. At least 12 German ships have been sunk and others damaged, and it is believed that a German warship has been damaged by these mines.

AMERICAN PRODUCTION

A Mid-June News-letter from a Correspondent in Washington

THIS letter is being written as the final act in France's present tragedy is unrolled. The Anglo-French Purchasing Board has not yet made any public statement regarding the disposition of the French part (slightly more than half) of the 1,600,000,000 dollars (£400,000,000) of Allied orders placed in the United States so far. Not much more than 250,000,000 dollars (£63,000,000) worth of equipment has yet been delivered, but informed sources are certain that remaining French contracts will be taken over by the British Purchasing Commission, unless an émigré Government is set up to carry on the war. If this happens, it is possible that the present form of the Anglo-French board will be continued.

As British readers undoubtedly know, buying has been proceeding at a greatly accelerated rate during the last five weeks. Contracts totalling some 600,000,000 dollars (£150,000,000) have been signed in that time, according to a statement by the purchasing group. Of the grand total spent to date, more than 1,000,000,000 dollars (£250,000,000) is for aircraft—8,500 of them.

The Anglo-French Purchasing Board says that more than 2,000 of these have already been shipped. Some 500 others (Hudsons, Hawk 75As and Harvards) were delivered before September 3. Another 500 await shipment. About 3,300 of the still-awaited 6,000 were ordered for France. Yet another source just opened up, of course, is Army and Navy air service equipment declared obsolete and traded in by the Government to the manufacturers for resale to Britain—a nice legal manœuvre which should show where American sympathies lie. Less than 200 Army and Navy machines have been turned over to Britain in that way at the time of writing. The release programme has slowed down in the last couple of days, either because shipping facilities for additional machines are not immediately available or until the uncertainty over the French surrender and its effect on the war is cleared up. But other aircraft will undoubtedly be made available shortly. Army types will predominate. The Navy is still the first line of American defence and its active squadrons will be the last to be stripped. The first aircraft released were Navy machines, but they were from reserve units whose personnel had, in any case, been called to serve as instructors in training schools.

Variety of Types

Just about every military type currently made in the United States is under order for England. Besides the types previously reported by this correspondent, England will shortly receive 120 Vultee Vanguards, originally ordered by Sweden, and 24 Northrop single-engined twin-float seaplanes intended for Norway. (John K. Northrop, one of America's most talented engineers, is back in the manufacturing field with his own company and several revolutionary ideas. Northrop's older company was absorbed by Douglas some years ago.) The Vanguard, an easily assembled fighter, does about 320 m.p.h. when powered with a Pratt and Whitney Twin Wasp C 14-cylinder air-cooled radial (1,200 h.p., take-off). A version powered with the Double Wasp (18 cylinders, 1,600 h.p., take-off) and capable of 370 m.p.h. was built for the Army, but the Army turned thumbs down.

The Purchasing Board has ordered (originally for French use) as many Douglas B-20 and Martin 167W attack bombers as can be built, up to 150 each a month. Most of the Douglases (15,000 lb. gross weight; two two-row Cyclones; 375 m.p.h. (?)) will be built in the Boeing (Seattle) and Consolidated (San Diego, Calif.) plants, as Douglas is not interested in further plant expansion. This is the first time a large-scale licensing arrangement has ever been made in the United States, and is a major step toward standardisation of the industry. Earlier Allied attempts to secure industry-wide standardisation on three models were unsuccessful. Martin will build all of the 167Ws—not nearly so speedy a type (16,000 lb.; two Twin Wasps; 315 m.p.h.).

Just three days before Marshal Pétain sued for an armistice the French mission signed for delivery of 120 Consolidated B-24s in 1941. These are the 20-ton four-engined (Twin Wasps) bombers with a speed of nearly 300 m.p.h. They are in the "flying fortress" class, but cannot be called that because Boeing had the forethought to register the title as a trade mark. Boeing, builders of the original "F.F." type, the B-17, are also building long-range high-speed machines to Allied orders. They are known as the B-17D model. Redesigned from the landing wheels up, the new B-17 is said to be good for 330 m.p.h. top speed. Both Consolidated and Boeing types are also on order for the Army, but the Army will wait. The French had also contracted for 110 four-engined Consolidated flying boats of the PB2Y-1 U.S. Navy model.

Two further items may be of some, though very small, comfort in these trying days. First, production of the Curtiss P-40D fighter is really under way at a good rate, and secondly, the Allison Engineering Company, whose V-1710-C6 twelve-cylinder diethylene-glycol-cooled engine has been so eagerly awaited, finally got production started two months ago in its first plant. A second plant, paid for by the Allies, is nearing useful work. But production of this engine still lags behind airframes designed to take it.

The only important new aircraft types to make their appearance in the last two months are the Grumman Skyrocket twin-engined fighter designed for aircraft carrier operation, and the Bell XFL-1, fleet fighter version of the Airacobra. The Skyrocket uses Twin Wasps (the prototype had Cyclones.—Ed.) and the Navy swears it will outpace Lockheed's Allison-powered P-38. No data are yet released. This type and single-engined Grumman and Brewster monoplanes (just over 300 m.p.h.) have been ordered by the Allies. Eighty Grumman F4-F3s were to go to France.

Rates of Production

Actual production of military aircraft (and the Allies are getting practically every one built) is now running at the rate of about 500 a month, with a good likelihood of reaching 700 or 800 monthly by the end of the summer. Deliveries have been consistently ahead of schedule, although almost the only large plant which is actually now working at all-out capacity is Douglas. Eighteen thousand men are employed around the clock at the Santa Monica factory in California. (A three-shift maximum of 17,000 is the designed capacity labour force.) At several plants this winter there were slight delays due to engine shortages, but this has been corrected.

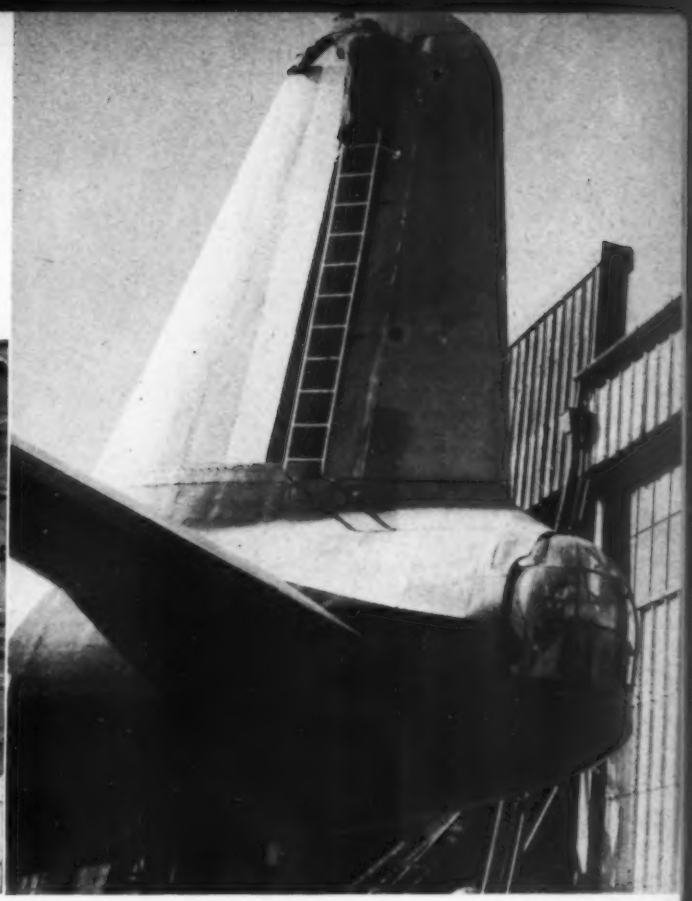
The Wright Aeronautical Corporation the other day dedicated the fourth major engine plant addition to go into service in the United States since war began. Production is currently for over 1,000 engines a month and should pass 2,000 by the end of the year. Further expansion plans are liable to boost even this output.

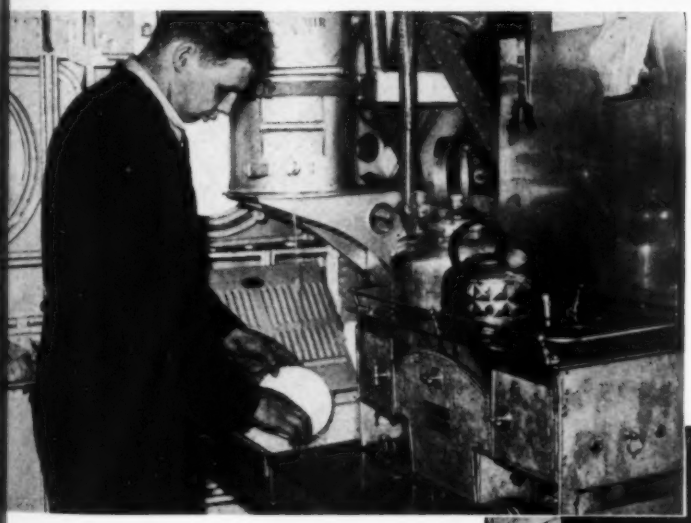
At one other aircraft factory, an airscrew shortage was reported, but Curtiss now has about as large a plant as Hamilton Standard, and Hamilton Standard has grown mightily. At some plants visited recently by the writer aircraft were quite often being turned out faster than the Allies could take them away. Recent easing of flight delivery regulations under the Neutrality Act (non-stop into-Canada trips by American delivery pilots are now allowed) should at least get the machines as far as Canada's Atlantic ports.

This survey of American production as it affects the Allies would be incomplete without one final note: North America is reported to be building a single-engined fighter around that Allison W-shaped engine of 2,000 h.p. The new N.A. prototype has not flown yet. Will it be in the 500-mile-an-hour class? (No!—Ed.) More important, will it be ready in time?

AERIAL SEAMANSHIP

New Pictures of Our Largest Flying Boat





DAY in, day out, summer or winter, the Short Sunderlands are out and about their business of submarine patrol, convoy protection, offensive bombing or any of the hundred and one duties on which a first-class military flying boat can be employed. These Bristol-engined boats are also building an enviable reputation for themselves as fighting craft, as some Messerschmitts have found to their cost. Roominess is one of their outstanding features, each boat has sleeping and feeding accommodation for the entire crew in addition to the usual gun positions.

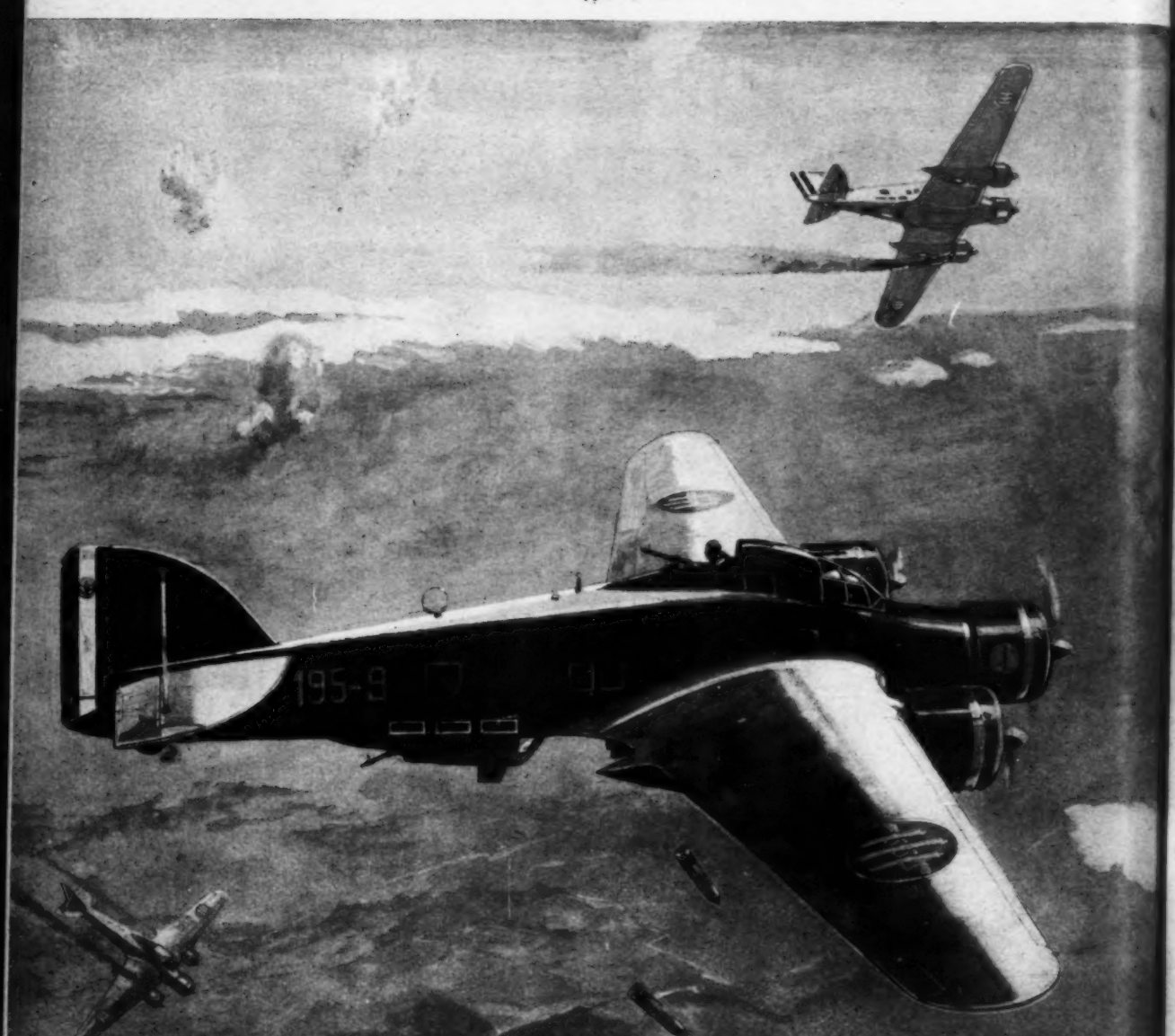
Basically the Sunderland is a militarised version of the well-known Empire Boat which has given such excellent service on the civil routes to Africa, India and the Antipodes.

(Top right) Some idea of the size of the tail surfaces can be gained from this picture of an aircraftman cleaning down the fin.

(Top left) In the nose, beneath the retractable gun turret, is situated the bomb-aimer's position. To be able to sit comfortably and have plenty of room must have a good effect on results.

(Above) In the pantry. Even in the best of flying boats "washing up" still has to be done. The container behind the cook's head holds a supply of drinking water.

(Right) The navigator's position is on the top deck to the rear of the pilots. There is plenty of table and drawer space for maps and instruments.



A hypothetical action picture centring round a Savoia-Marchetti S.M.79 three-engined bomber of the Italian Air Force. The location of the upper and lower 12.7 mm. guns can be clearly seen. A fourth weapon is sometimes carried inside the fuselage and arranged so that it may be fired on either side through a window. All the guns are manually trained and aiming is rendered more difficult due to their bulk and weight. Everything considered the S.M.79 should be an easy proposition for R.A.F. fighters.

SAVOIA-MARCHETTI S.M.79
Three Alfa Romeo 126 RC.34 Engines.

DIMENSIONS

Span	67ft. 3in.
Length	53ft. 2in.
Height	13ft. 6in.
Wing area	656.5 sq. ft.

WEIGHTS AND LOADINGS

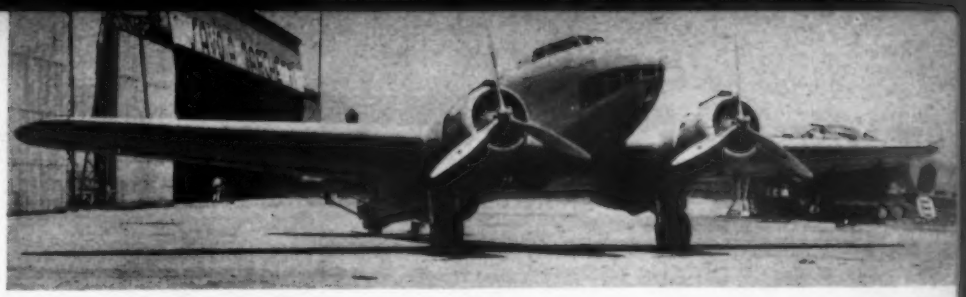
Weight empty	14,990 lb.
All-up weight	22,156 lb.
Wing loading	33.75 lb. sq. ft.

PERFORMANCE

Top speed at 12,450ft. ...	270 m.p.h.
Cruising speed at 16,400ft. on 70 per cent. power ...	248 m.p.h.
Cruising speed at 16,400ft. on 60 per cent. power ...	223 m.p.h.
Climb to 3,280ft.	3 min. 10 sec.
Climb to 6,560ft.	6 min. 20 sec.
Climb to 9,840ft.	9 min.
Climb to 13,100ft.	13 min. 15 sec.
Climb to 16,400ft.	19 min. 45 sec.
Service ceiling	22,950ft.
Take-off run	328 yd.
Landing run	383 yd.
Range at 223 m.p.h. with 2,640 lb. bombs	1,145 miles.
Range at 223 m.p.h. with 1,100 lb. bombs	1,615 miles.

DATA FOR S.M.79
With Three Piaggio PXI RC.40 Engines.

Weight empty	16,750 lb.
All-up weight	24,910 lb.
Wing loading	37.9 lb. sq. ft.
Top speed at 16,400ft. ...	295 m.p.h.
Cruising speed at 18,000ft. on 70 per cent. power ...	254 m.p.h.
Cruising speed at 18,000ft. on 60 per cent. power ...	245 m.p.h.
Climb to 9,850ft.	7 min. 50 sec.
Climb to 13,100ft.	10 min. 25 sec.
Climb to 16,400ft.	14 min. 30 sec.
Service ceiling	27,850ft.
Take-off run	306 yd.
Landing run	395 yd.
Service ceiling on two engines	18,000ft.



The Savoia - Marchetti S.M.79B, a twin-engined version of the S.M.79. It will be seen that the nose of this machine has been completely redesigned in order to accommodate the bomb-aimer.

THE SAVOIA-MARCHETTI BOMBERS

S.M.79 and S.M.81 Tri-Motor Types : A Twin-Engined Dive-Bomber

PREDOMINANT among Italian bombing aircraft is the three-engined Savoia-Marchetti S.M.79 monoplane. In effect this machine is the counterpart of Germany's Heinkel He lll and has been in production for about the same length of time. Like the Heinkel, the S.M.79 bomber first appeared as a civil type, but was patently suited to military use rather than to economical commercial operation. Since its appearance in 1935 the machine has made a number of flights of distinction and has broken various records. Stripped of its armament and fitted with supplementary tanks, it was victorious in the International Istres-Damascus-Paris Air Race and made a very fast flight between Rome and Rio de Janeiro in two stages. Together with the older and slower S.M.81 it was used with a measure of success in Spain.

The S.M.79 is arranged as a low-wing cantilever monoplane and, like the majority of Italian bombers, is of mixed construction (wood and metal) and fitted with three radial engines. Manufactured in one piece, the wing is of wood, though metal attachments are provided for the fuselage, engine mountings, and undercarriage. Fuel tanks are slung between the spars and can be easily removed through special openings. Slotted flaps extend along the trailing edge between the ailerons and the outboard nacelles, and the ailerons themselves, while retaining their differential action, can be used at the same time as flaps. Outboard of the engines the leading edge is fitted with Handley Page slots to ensure lateral stability at low speeds. Three "double T" section spars connected with plywood ribs form the basis of the wing structure; the covering is of plywood and forms part of the stress-resisting structure. A notable advantage of the wooden wing is the degree of flotation provided in a forced descent on to the sea.

Welded steel tubes are used for the main fuselage section. In the forward part the covering is of duralumin sheet, though the top is covered partly with plywood. Fabric is used for the covering of the sides and bottom, and the wing/fuselage junctions are carefully faired by duralumin fillets.

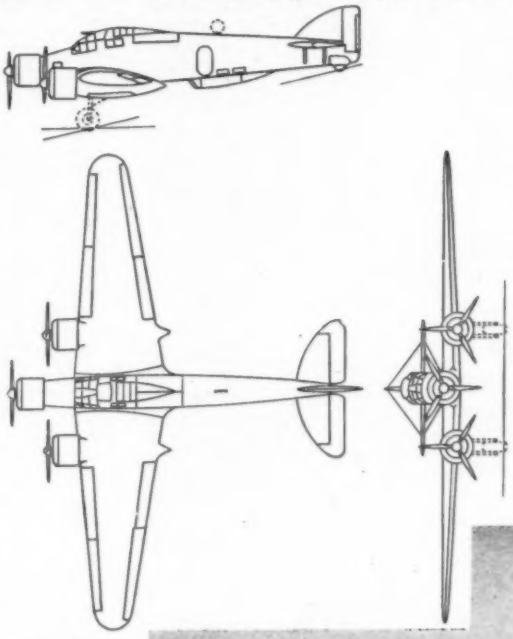
Behind the nose engine is a fireproof bulkhead, followed by the pilot's cabin with dual controls. Seats for the wireless operator (starboard side) and mechanic (port side) are situated aft of the pilot's compartment. In the central portion of the fuselage are the bomb racks and the bomber's cabin, provided with a duplicate rudder control, a board of flight instruments, bomb sight and release, and, if necessary, a camera. All compartments of the fuselage are easily accessible from each other.

Steel tube frameworks with fabric covering are used for the tailplane. The rudder and elevator are statically and aerodynamically balanced, and the tail wheel is partly enclosed.

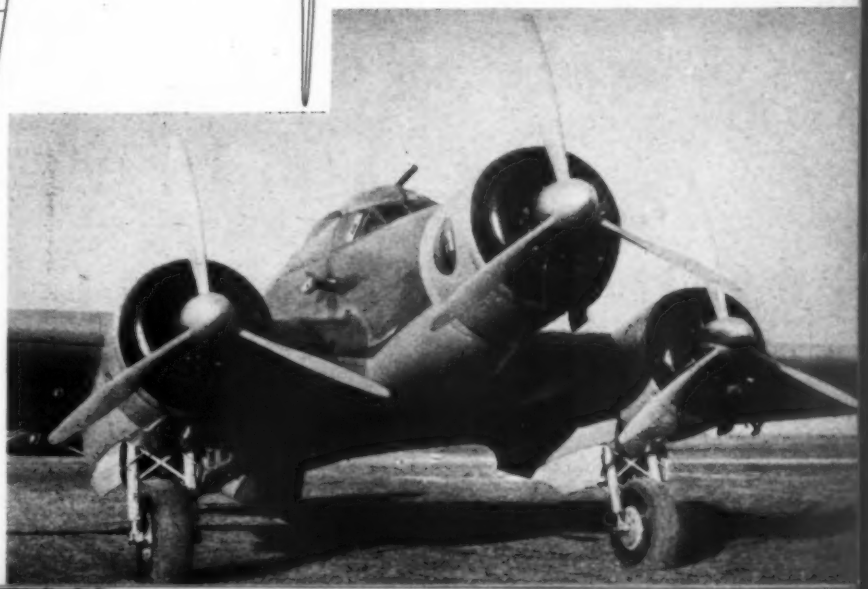
Undercarriage and Engines

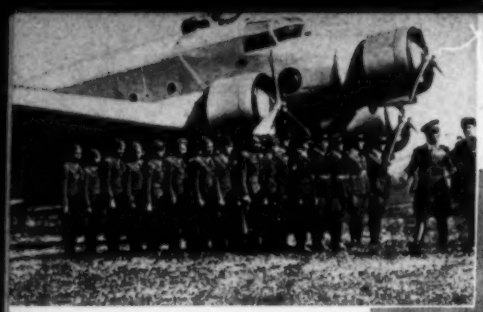
The undercarriage retracts into the outboard nacelles. Each main unit consists of a fork equipped with oleo pneumatic struts carrying a wheel with brake and medium-pressure tyre. Retraction is effected by a hydraulic pump driven from one of the engines, and an emergency hand pump is provided.

S.M.79s of the Italian Air Force are fitted with standard three Alfa Romeo 126 RC34 nine-cylinder air-cooled radials, which are of Bristol Pegasus type. Each of these units has a normal output of 750 h.p. at 2,300 r.p.m. at 11,150ft., and a maximum output of 780 h.p. at 2,415 r.p.m. at 11,450ft. On 100 octane fuel 930 h.p. is available for take-off. The engine mountings are of welded steel tube and are provided with S.I.A.I. vibra-



On the left are three-view drawings of the S.M.79 and below is a close-up of the nose showing the installation of the Alfa Romeo engines. These are of the Bristol Pegasus type, built under licence.





The upper view shows the forward turret on a Savoia-Marchetti S.M.81 bomber. This is hydraulically operated and houses two interconnected 7.7 mm. guns.

During the Spanish war Savoia-Marchetti S.M.81 bombers were usually escorted by C.R.32 fighters, as shown on the right.

tion dampers. The airscrews are of the Alfa Romeo three-bladed variable-pitch type.

Equipment includes a retractable landing light and complete electrical gear. The normal armament is three 12.7 mm. Breda SAFAT machine guns. One of these is fixed and fires from a point above the pilot's cabin; of the other two, one is on a mounting on top of the fuselage, and the second below the fuselage. That above the fuselage, when not in use, is covered by a streamlined fairing which gives the machine a humped-backed appearance. A fourth gun (probably 7.7 mm.) can be mounted as optional equipment on a sliding mounting inside the rear section of the fuselage. This can be fired through a window on either side of the fuselage. If attacked by our manœuvrable, heavily armed fighters it is unlikely that the S.M.79 could make much of a showing, as its size and high wing-loading make it comparatively unmanœuvrable for the employment of the fixed gun, and the bulk and weight of the free weapons and the fact that these are on manually operated mountings render them difficult to fire at any appreciable angle out of the line of flight. Being of heavy calibre, their rate of fire is quite slow, though the effect of a hit from a 12.7 mm. bullet might under certain circumstances be appreciably greater than from a projectile of rifle calibre.

A total bomb load of 2,755 lb. is carried, vertically stowed, in the fuselage. Typical loads would be two bombs of 1,100 lb., or five bombs of 550 lb., or twelve bombs of 320 lb.

S.M.79B

Although the makers claim that the bomb-aiming facilities on the S.M.79 are adequate, the nose engine must be a handicap. Better facilities are provided in a twin-engined version with a redesigned nose designated the S.M.79B. This type is not used in quantity by the Italian Air Force, but has been supplied to the Argentine Government, Rumania, and Iraq. Fitted with two Fiat A80 RC41 engines, the S.M.79B attains a top speed of 254 m.p.h. and climbs to 13,000ft. in 16 min. 40 sec. When the writer was in Milan in October, 1937, he was told of a projected version of the S.M.79B fitted with 1,400 h.p. Alfa Romeo radials. He also learned that during demonstrations before the Argentine Government a question was raised as to the manœuvrability of the S.M.79B and that the Savoia pilot executed four or five loops.

Savoia - Marchetti S.M.85 single-seater twin-engined dive-bombers. The diving brakes are lowered to 90 deg. and enable bombing attacks to be made at any angle up to the vertical.

S.M.81

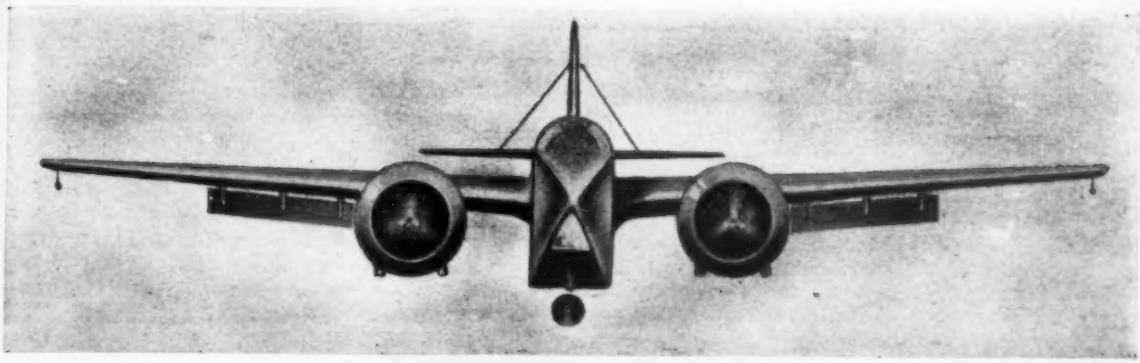
Despite its designation, the S.M.81 is an older and slower type than the S.M.79. It, too, was developed from a civil type, the S.M.73, and its performance is inferior to that of our obsolete Handley Page Harrow.

The S.M.81 is a three-engined low-wing monoplane of larger dimensions than the S.M.79 and with a fixed undercarriage. In a number of respects it has an outward resemblance to the Junkers Ju 52, but it is, of course, of mixed construction. The wing is of wood, and the fuselage of welded chrome-molybdenum steel tubes with fabric covering.

Some of the S.M.81s in service have 700 h.p. Piaggio Stella IX RC radials, others have Gnome-Rhone K14s, and the remainder Alfa Romeo Pegasus-type engines. In no case does the top speed exceed 200-210 m.p.h.

The normal armament comprises two retractable and rotatable hydraulic turrets, one above and one below the fuselage. In addition there is provision for a gun to fire through a window on the port or starboard side towards the rear of the fuselage. All guns are normally of 7.7 mm. calibre.

Bombs are carried internally, and vertical or horizontal stowage can be provided. The bomb-aimer's position is semi-retractable and is located behind the nose engine. Vibration



If the above picture is held overhead an idea can be formed of the appearance of the Savoia-Marchetti S.M.85 dive-bomber as it delivers its attack with air brakes lowered. On the right is a view of a formation of nine of these machines framed by S.M.79 bombers on the ground. The same formation of S.M.85s is illustrated on page 20.

and the clouding of the screen with oil are two potential disadvantages.

An experimental installation was made of two Isotta Fraschini liquid-cooled Vee twelve engines in place of the three radials, and a nose similar to that of the S.M.79B was incorporated. Although the S.M.81B, as the modified machine was called, was tested at Guidonia, it is not thought that quantity orders were placed.

S.M.85

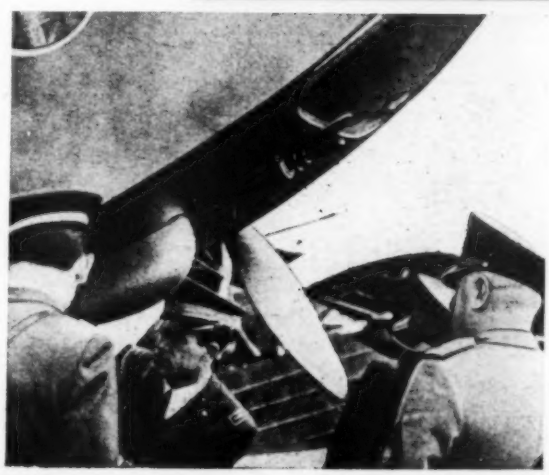
One of the latest products of the Savoia-Marchetti concern is the S.M.85 single-seater twin-engined dive-bomber, which first appeared in public on June 11, when Press representatives were entertained at Guidonia and a flying display given before the Duce. *Flight* reported: "The final event was a dive-bombing attack by a flight of the new Savoia-Marchetti twin-engined single-seater monoplanes. These machines dived almost vertically, using air brakes, on an imaginary target in the centre of the aerodrome, and then roared overhead in a shallow dive, with their engines opened out and brakes off."

The S.M.85 is easily recognised by the characteristic sweep-up of the bottom line of the fuselage to the single fin and rudder, and the forward situation of the pilot's cockpit enclosure.

Arranged as a shoulder-wing monoplane, the machine is mainly of wooden construction. The wing has a moderate taper toward its rounded tips, and inboard of the ailerons are trailing edge diving brakes which hinge downward so that daylight can be seen between the flaps and the wing when the machine is diving.

The fuselage is slab-sided and has external longitudinal stiffeners. The rudder has a rounded contour, though the fin is straight edged, and the tail-plane is braced.

In the bottom of the fuselage at the extreme nose is a window for the use of the pilot either during the run-up to his target or, should he double himself up to minimise the effect of "G" during the pull-out, in the dive itself. It is believed that the engines are of the Piaggio PX RC 35 type.



An officer of the Italian Air Force explains to Signor Mussolini the bomb gear of the S.M.85. Forward of the bomb traps is a Breda SAFAT machine gun (the external fairing holds empty links and cases) and the floor window.

AIR STRATEGY

A Two-power Standard No Longer Sufficient : Advice to the United States

By CAPTAIN NORMAN MACMILLAN, M.C., A.F.C.

FROM the aspect of the air strategist, the most important result of the capitulation of France is that the United Kingdom is now bereft of operational aerodromes situated on the mainland of the continent of Europe. All air operations against Germany must be launched from aerodromes in the United Kingdom or from the decks of aircraft carriers at sea. And by the word "Germany" one must visualise all that territory which is now under the military control of the German armed forces. This territory extends from North Cape in 71 degrees north latitude in Norway to the border between France and Spain in 43 degrees north latitude—a total distance in a straight line of just under 2,000 miles, and a far greater distance along the broken coastline which demarcates the western seaboard of the mainland of Europe.

To some extent the relative positions of Great Britain and Germany have been reversed. Germany, whose lines of communication were in radial straight lines, has now amassed a vast network of lateral lines of communication, many of which ought to be vulnerable to air attack.

Britain, on the other hand, has been forced to withdraw her expeditionary force on the Continent, and now has her Metropolitan forces concentrated in the United Kingdom. The British lines of air attack against Germany and Italy are radial lines spreading out fanwise from a concentrated area which has, as a safe source of supply, the great hinterland of the American continent, separated by the still comfortable distance of the Atlantic Ocean.

The Roles of the Services

It would appear that the general policy advocated for the immediate defence of the United Kingdom is one of "grin and bear it" for the interim period during which the strategical concept of Britain at war can be modified by the acquisition of the necessary war material of the requisite kind. In the meantime it is taken as an omen of good cheer that we were able to evacuate the British troops from Belgium and France. These troops, experienced in the methods of modern war, are a stalwart body upon which to rely for the action that may have to be taken to repel an attempt at an armed landing in this country, whether by sea or by air, or both. But they must be fully and adequately equipped.

The new conception of Britain at war is roughly this: The Navy will keep our waterways of supply open in collaboration with the Royal Air Force and the Fleet Air Arm. The Navy, the Air Force and the Army will combine in such action as may be required for the security of the Realm. The Air Force will be the arm of the Services upon which will fall the brunt of the immediate offensive operations against enemy territory and the forces thereon. Upon the Air Force will fall the work of harassing the enemy so that his supply arrangements will be interfered with to the maximum extent.

In other words, with no fanfare of trumpets, and no clear statement of the position from anyone, either in or out of the Services, the Royal Air Force has quietly slipped into that position of predominance for which its best friends have worked for years.

I could mention numerous names. They were unpopular, even in the Air Ministry, a few years ago. They were too openly clamant in their demands that the Air Force should come first. They frightened even the big people in the Royal Air Force and the Air Ministry. They called down upon their heads time and time again the age-worn cliché about the interdependability of the three Services—a matter which they had never denied. They were looked upon as fanatics. They were shunned because they were a nuisance.

If they criticised the Air Ministry and the Air Force it was because they wished these two well. They were truer friends than those who said that in no circumstances were they prepared to criticise the Air Ministry. Such sycophancy was definitely harmful, but it was lapped up in high places because it went down like treacle.

Attack Germany

Now, under the most fearful stress, in the time of Britain's greatest crisis, the Royal Air Force has, perforce, had thrust upon it the rôle for which the heretics worked. Had they been heeded in the days of plenty the Royal Air Force would be a stronger force to bear the task which is now laid upon it.

The heretics who demanded a Two-Power Standard for the Royal Air Force were right. It is the minimum standard that we need to-day. Indeed, before this war is finished to the glory of the Old Country and her sons overseas, we shall need far more than a Two-Power standard in the air. For it is to the air that we must look for victory—and by that I mean no disparagement of the other Services.

No doubt the sea blockade will play a part, and a noteworthy part, in the long-term operations. But of itself it will not command final victory. And not until the British air force is built up to a strength greater than that of Germany and Italy combined (aye, and perhaps that of Japan, too) can we count on being able to initiate those major operations in the theatres of war which will bring about the end we seek.

In the meantime we in these islands must be prepared to take it in the rough way that Robert Service outlined: "If you're up against a bruiser and you're getting knocked about, Grin."

While the Royal Air Force has now to deal with long enemy lines of communication and with the great dispersion of enemy forces (with bodies concentrated at points which might be key points whence attacks upon Great Britain might be launched) it must also deal with the main centres which supply the enemy's accoutrements of war. That means Germany, and to a lesser extent Italy. Industrial Germany must be attacked consistently and without interruption, no matter how pressing are the other targets which demand the attention of our bombers. During recent weeks Germany has received a considerable degree of attention from the bombers of the R.A.F. That pressure must be kept up and increased. There may be need for some

AIR STRATEGY (CONTINUED)

reorganisation of the Air Force to secure that end. It seems to me that there ought to be a section of the R.A.F. set apart and charged with the duty of concentrating attacks upon Germany, no matter what happens elsewhere. Whatever we do by way of smashing up the territories of our Allies and ex-Allies during attacks upon bodies of enemy troops operating in and from those territories, we must remember that, although these operations may have an immediate effect upon the day-to-day operations of the enemy, they cannot produce the direct effect upon the population and industry of the enemy that attacks against training centres in Germany, industrial centres in Germany and every centre of storage of supplies in Germany will produce.

The enemy knows that it is to his advantage to do everything in his power to force us to deflect our attacks to objectives outside the Reich. We ought not to permit ourselves to be so deflected. And the very fact that the enemy must bomb targets inside the British Isles will give us the necessary fillip for retaliation.

So much at the moment for the situation in regard to Great Britain. The war will not be fought from Great Britain alone. There is another great front in and about the Mediterranean still, despite the withdrawal of France. And from that front there is the problem of Italy as well as that of the Italian overseas possessions. There is, too, the problem of the French Colonial possessions.

If Great Britain Lost

In regard to the war of the overseas possessions, it is perhaps desirable to look upon it at the present time as a secondary main theatre of war, which may, however, become of greater importance as the war progresses. There is the opportunity, and the present possibility, in those lesser theatres of war, of local successes to the British forces. What will happen to the French Colonial possessions is not yet clear. But one thing is certain. It is that the main pressure of the enemy will be put upon Great Britain, because it is still (in spite of all efforts which have been made in the British overseas portions of the Commonwealth and in the United States) the principal arsenal of the British Empire and of all who are on our side. If that arsenal can be put out of commission, the resisting power of the overseas forces of Britain and of any of the French forces which continue to resist the enemy in spite of the French Armistice signature will soon be worn down. More than that, Great Britain is the financial mainstay of the anti-Germano-Italian front. If Britain cannot withstand the assaults of the enemy, the financial power to continue the war against Germany and Italy will have been broken.

Thus, were Great Britain to succumb to enemy attack, the war must change to one between the two hemispheres. And that would happen quickly. So it is imperative (not for the sake of the Western nations) that Great Britain must hold out. At all costs, and no matter what happens here, the British people will have to stick it and grin and bear it. And by doing so, if they hang together, in the end they cannot lose, provided that the British policy adopted is one of constant, continuous and increasing air pressure against the home territories of the two enemy countries which now confront us. All the weight of air attack which we can spare from the day-to-day requirements of tactical necessity on the home and overseas fronts must be directed against Germany and Italy. Blow after blow must fall upon those two countries. There must be no respite. And if those blows are aimed aright they will result in a diminution of the force which can be directed against us.

The correct policy was adopted against Italy almost as soon as she entered the war. The Ansaldo, Fiat and Caproni works were attacked by air. Why were the German factories so long immune from such attacks? There ought to be some explanation. And if it is not politic that such explanation shall be given to the public, it ought to be sought and obtained by Members of Parliament during one of their secret sessions. There must be no more security for German armament works to continue the manufacture of arms for the destruction of the British Empire and the other nations which are not in the Nazi-Fascist ring.

I marvel at the attitude of the people of the United States. I could understand their attitude in the days when, on April 7, 1938, Major Lester Gardner (well known over here) wrote into his review of my book, "The Chosen Instrument," the following paragraph: "To those who look to the future with the hope that the United States may not become involved in any war on any other continent, the idea of having huge aircraft armament factories with airports for testing and airways for delivery placed just over the Canadian border is preposterous." No so preposterous to-day!

Yet, even now, the United States has not awakened to the real meaning of what is happening in the world. In spite of skilled writers who have written some of the best retrospective studies of the events of the past ten years, her people (if it is true that a Democracy is governed by the will of the people) have not yet grasped the fact that if America shrinks from the war, the war will not shrink from America. Not even three thousand miles of ocean will immunise America if Britain were to lose (which last I do not admit). But it would be a fairer show, all the same, if America were to play her part at the right time, which is now.

One at a Time

There can be but one consolation for aviation enthusiasts if the war develops into a war between two hemispheres. It is that the design of aircraft will be vastly stimulated. Then, war aircraft will have a cruising radius of action of 5,000 miles. And so I give America a hint. Let her get ahead with her aircraft design, building bigger aircraft than the world has yet seen, so that in the days to come, if we do not succeed without her help in bombing the enemy countries into submission, she will have taken advantage of the preoccupation of Europe to get ahead with her aircraft design so that she will be able to bomb Germany and Italy from the Western Hemisphere. And let my good friends in both North and South America understand that if we cannot defend the British Isles from the assaults of the enemy, they will have no hope whatever of defending a vastly greater island, whose population density and man power per mile of seaboard is infinitely smaller, until they have a Ten-Power Standard in the air.

Already America has begun to profit from the war as she profited from the last war by the acquisition of new designs. The Merlin and Hispano engines have been released to be built in America. And that is only the start. I wonder, if America were the last bulwark in the world, as Britain is the last bulwark in Europe, would she pledge herself to reinstate every nation which has been conquered, unconditionally, as Britain has? She has made this pledge in relation to the States of all the Americas, north, central and south, as a pledge of

AIR STRATEGY (CONTINUED)

defence. But she has dissociated herself from the affairs of the Old World. Her outlook is inconsistent. There cannot be one law for the New World and another law for the Old. America cannot live a life apart. What Great Britain fights for to-day America must fight for to-morrow if Britain were to lose. And against the forces that would then be arrayed against her, America could not preserve the New Hemisphere. If every American citizen had flown along parts of the seaboard of the Atlantic coast of South America (as I have), he would realise that enormous lengths of that coast are undefended, and with the man power available are indefensible.

This new battle in Europe, which has been dubbed (as far as I know by our own politicians) the Battle of Britain, is falsely named. It should have been called the first stage of the Battle for America. Perhaps that would have aroused Americans to realities.

Every successive State has made the same mistake with Hitler; they have allowed him to concentrate on one target after another, one at a time. By the time they had prepared to intervene, intervention was too late. And America, with every lesson spread before her, is acting as the others have acted.

At the present time we have no need for a big expeditionary force. Our need is for aircraft fully manned and (even though we have much of the French Fleet) for ships. America could supply both, and they might turn the balance at a small cost if they were supplied now. But I am afraid that the only sights of the American Army and Navy air forces we are likely to get here for the present are celluloid versions from Hollywood. The world's most advertised air forces have gone back-stage. But a friend of mine in South America tells me that news reel shorts depict the victories of U.S. types of aircraft in the R.A.F.; to South American audiences the Royal Air Force must appear to be equipped almost entirely with American aircraft. So it looks as if John Bull needs to brush up his propaganda machinery in the New World. As Herbert Morrison says, let us "Go to it."

EVACUATION of the CHANNEL ISLANDS

Good Work by Jersey Airways : DH86s Busy

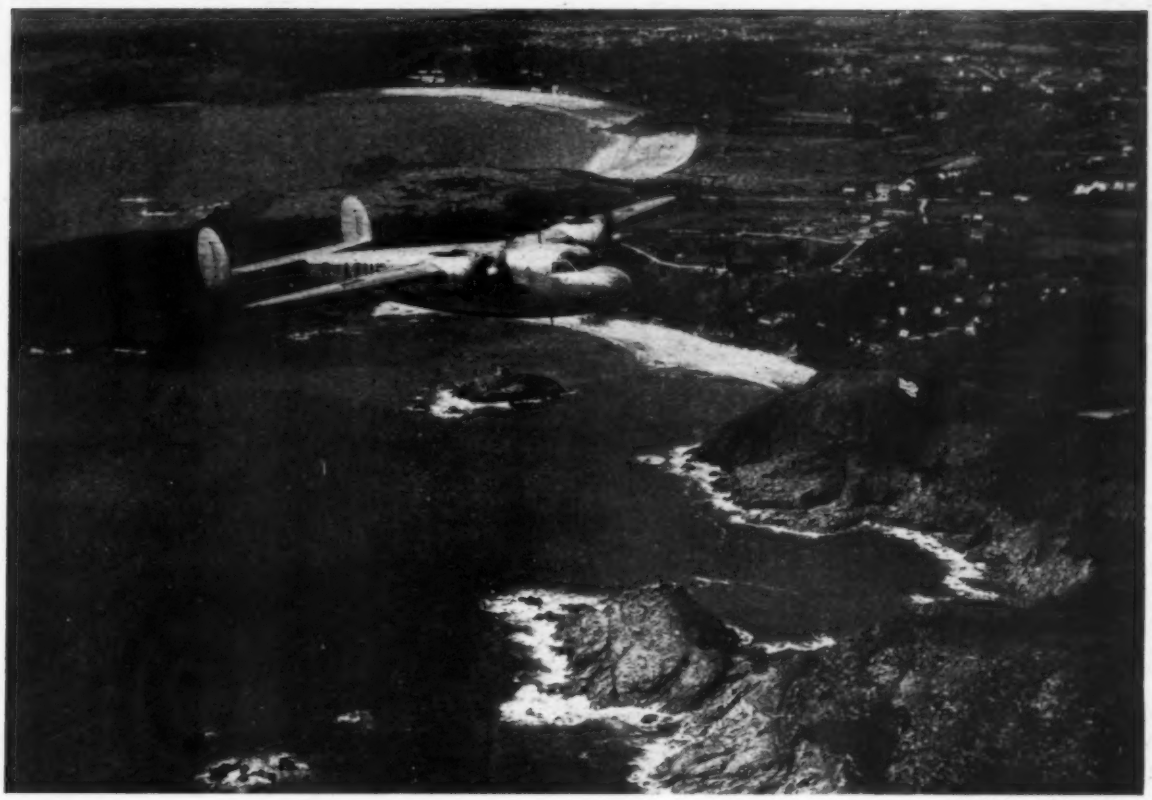
ONE of the few remaining British air transport companies will now fly only through the fog of war, for its civil activities have perforce ceased with the German occupation of the Channel Islands, which occurred on Sunday, June 30. Jersey Airways are no longer able to fly this route and the many holiday passengers and others whom they carried will have heard the news with great regret. However, the general manager, Mr. G. O. Waters, when interviewed at the temporary office of the company in a London hotel (where they are at present "refugees"), said that their plans for the future were encouraging as the company would retain its identity and organisation and work in conjunction with the Air Force under Air Ministry instructions.

The Channel Islands are the only British possession to suffer German occupation in this war. They involved a diversion of too much naval and air strength to be worth holding, as they are situated so close to the French coast (about 25 miles). The Germans have, of course, seized them for their food-producing value, even though small, and for their aerodromes, which may be useful to them for attacks on Channel shipping.

After the suspension under Air Ministry orders of its regular services on June 13, the company's evacuation scheme came into action, and on Friday, June 14, the wives and families of the staff were transported by air to England in the company's fleet. On the Saturday, the aircraft were used to transfer equipment, stores and five spare engines, as it was hoped to keep operating the services from a base in England. Maintenance personnel went too, except for a skeleton staff, which was to do the Islands end of the maintenance work. This transfer was helped by the arrival of two Ensigns (carrying R.A.F. men) which would otherwise have gone back empty. In fact, the com-

"Flight" photograph.

Good-bye to Jersey. A DH86 of Jersey Airways circles the aerodrome. Five of these aircraft were used in the evacuation. Opened in March, 1937, the aerodrome was very welcome after three years of beach landings.



"Flight" photograph

A view British air travellers (except the R.A.F.) will not see again until the war is over. The Jersey coastline with a DH Flamingo en route to Heston.

pany is very grateful for all the Air Force help it had, as various service aeroplanes which landed on the Islands in the course of their work aided by carrying items of company property to England.

As far as property is concerned, the company has suffered the minimum of loss. It has got out all its movable equipment and lost no aircraft. But the staff have, of course, suffered heavily by the abandonment of their homes. Mr. Waters praised the staff highly for their behaviour during the evacuation. It had been planned previously and, with their efficient support, he was able to direct it so that it proceeded smoothly. In peak holiday time the total staff amounted to about 180, of which 100 were engaged on maintenance. The flying staff consisted of 12 crews (captain and radio operator) for the operation of the six DH86s and one Flamingo which the company then had. Mr. Waters, the chief engineer and the traffic manager left Jersey on Sunday, June 16.

On the following Tuesday and Wednesday (June 18 and 19) the fleet of DH86s flew from dawn till dusk evacuating people to a West Country town. Five of the fleet of six were in use, and a total of 320 people were transported. During this time demolition parties of the Royal Air Force had been at work, and property which would have been of use to the enemy, such as motor cars, was destroyed. The Air Force then left.

Evacuation of civilians by ship was then proceeding, and it was no longer necessary to use aircraft. In fact, it was found that the aircraft tended to cause confusion as some of the refugees who were trooping southward across Jersey to the harbour at St. Helier started to retrace their steps and go towards the aerodrome when they saw an aeroplane overhead.

Radio communication had ceased some time before this by order of the Air Ministry, but communication by telephone was possible right up until the day of the occupation. On Thursday, June 20, two aircraft were sent across from England to bring out the skeleton maintenance staff and the airport staff, but Mr. Roche, the controller, and a few others still remained.

Previous to this, ships had taken everybody off Alderney and, with its aerodrome mined and suitably "obstructed," it was left, a deserted island. From the Islands, the black smoke of bombing could be seen rising drearily from the coast of Normandy, south of Cherbourg, as the Germans threatened and finally took that town. And as the aeroplane carrying the last of the Jersey Airways staff flew northward to England and safety, numbers of small boats could be seen pushing out from the coast of France, vainly seeking to escape from Nazism. Perhaps Alderney is no longer a deserted island.

The control building at Jersey Aerodrome is a businesslike structure well adapted to its duties.

TROOP-CARRYING GLIDERS

Their Technical Possibilities : Silent Approach : Gathering in Norway?

THE German war machine has sprung some surprises, not only in new weapons of war but in new uses of existing weapons. The co-ordination of tank and aircraft attack was a new method, while the magnetic mine and the parachute were new weapons. The parachute was not new in the sense that we had not heard of it before. We had—but we scorned it. "They will all be dead before they are on the ground," we said. And we would have been right, but for the combination of the parachute with that oldest of "weapons" of war, the enemy within the gates. Calling it the Fifth Column does not make it a new development, but the way it works is new.

We are now aware of these weapons—let us hope our tactical people have worked out the necessary means of countering them—but are we fully aware of all other possibilities, not merely the probabilities?

If Germany invades this country, what are all the possibilities, even the remote ones, for the transport of troops? (Here let it be said that thought should also be given to what will be regarded by most people as the remotest of all possibilities: that Hitler will not order an attempt at invasion before this winter, but will instead attempt to blockade us.)

The Towed Glider

Troops can be brought to this country on the sea, under the sea and over the sea. The Navy must deal with those on the sea in surface ships. If Germany decides to use submarines for the transport of a few specially valuable men, it is again the Navy's job and that of coastal defence (Army and Air Force). (If any reader feels scornful of the chance of a submarine landing troops unobserved, has he forgotten that a submarine got in—and got out of—Scapa Flow and sank a battleship?

But let us now look at the possibilities of troop transport *over* the sea, the troops by air. The troops who will descend by parachute we know of. Their job will include the seizure of at least one aerodrome. And we know the technique of carrying troops in troop carriers such as the Junkers Ju52, Ju86 and the four-engined Ju90. Such aircraft can only land on aerodromes.

But what of the towed glider? Is this another secret weapon? Let us examine its potentialities. It might be possible for each power aircraft to tow one glider carrying about 10 soldiers complete with ordinary equipment. Perhaps more than one could be towed, but the chances of accident involving the whole train would be greatly increased if more than one glider were on tow.

The modern monoplane with retractable undercarriage has a lift/drag ratio at cruising of about 9 or 10. But the outmoded Ju52, with corrugated metal skin and non-retracting undercarriage and bad fuselage shape would be more like 6. With gross loaded weight of 22,000 lb. its drag is then about 3,700 lb.

A glider to carry 10 troops could be designed to have a very high disposable load. With a landing speed of 30 m.p.h. only a skid undercarriage would be needed. There would be no engine, no fuel or oil and no tanks.

Each soldier would weigh about 160 lb. and his equipment another 90 lb., making 250 lb. in all, and 2,500 lb. for the ten. In terms of its gross loaded weight, the weight of the glider would be made up as follows:—

Fuselage and controls	17 per cent.
Wing	16 ,, ,,
Skid undercarriage	2 ,, ,,
Tail unit	2 ,, ,,
Total structure weight	37 per cent.
Disposable load	63 ,, ,,
Gross loaded weight	100 per cent.

Using the figure of 60 per cent. for disposable load, gross loaded weight is therefore 4,200 lb.

L/D ratio should be at least 10, as the design could be made very clean, although the fuselage would be rather fat to house the troops and the wing rather large to give a landing speed of only 30 m.p.h. Drag is then 420 lb.

Total drag of the combination is 4,120 lb., an increase of only 11.4 per cent. over the drag of the Ju52. Allowing for some reduction in airscrew efficiency (they would not be constant-speed), the cruising speed would only be reduced from about 140 to 120 m.p.h. by the glider.

The outstanding advantage of transporting troops by towed glider (as well as in the troop carrier itself) is that the number is increased merely by a small reduction of speed. With 20 in the troop carrier and 10 in the glider, the increase in number is 50 per cent., a worth-while figure.

The technique would probably be to take-off before dawn and cross the sea, taking every advantage of darkness, weather or artificial fog (if there is such a thing). Gaining as much height as possible (probably not more than 10,000ft. would be possible for a Ju52 with glider), the glider would be cast off about 10 miles before reaching the coast. It could then cross the coastline, even against some adverse wind, as in still air it could glide 19 miles.

Its approach would be silent, and a diversion would have already been made for it by the troop carriers which had gone on ahead after casting off. The glider's chances of coming in to land before being shot by fighters cannot be dismissed as negligible, even though they would be, of course, completely at the mercy of a fighter, being unarmed and unarmoured. The whole thing hangs on the relative number of gliders (and other aircraft) and fighters.

It will perhaps be noticed that the word "shot" was used, and not "shot down." With an aircraft without engines or fuel, the fighter pilot's bullets might not shoot it down, even though they hit it. It would probably still glide down imperturbably, unless the control cables were cut, the pilot dead or the tail shot off.

For General Confusion

The gliders are, of course, "dead meat" to fighters, but that will not prevent them being used if Hitler thinks they will aid his invasion. A wave of infantry is "dead meat" to a withering machine-gun fire, but we have all heard stories of how wave on wave of troops have come on. Only unthinking people accuse German fighting men of not being brave. They may be cruel, but that is another story.

The low landing speed of the glider would be very useful as it could get down almost anywhere, despite obstructions in fields. A small proportion of troops might be hurt in landing, but it would only be very small if the landing speed were 30 m.p.h. The pilots need not be power pilots; troops specially trained just up to the standard required to land a glider would be adequate for this particular purpose.

The sort of troops that might be sent across the sea in such a manner would not be those intended for the seizing of any particular objective, as it would be rather uncertain where they would land once they had been cast off. They would be just "general confusion" troops who would join up with the main bodies as soon as possible.

Since writing this article a report has been released that the Germans are assembling a fleet of gliders at Vernes, near Trondhjem, on the Norwegian coast. If such a report can be relied upon, it is difficult to understand why gliders are being collected together at a point so far north of and so distant from the British Isles, the latitude of whose northernmost part, the Orkneys, is 59 degrees. The latitude of Trondhjem is 63.26, not much south of Iceland, which is at 64.40 north.

HERE and THERE

Another Magnificent Gift

MRS. IONIDES, sister of Lord Bearsted, has given the Ministry of Aircraft Production £21,750 for the purchase of aircraft. She expressed the hope that other wealthy women would follow her example.

Flight Over Eire

THE flight of all civil aircraft to, or over, Eire and its territorial waters is prohibited, unless special permission has been previously obtained from the Minister for Industry and Commerce.

For Master Pilots Only

WE have been asked by Phillips and Powis Aircraft, Ltd., to point out that the Miles Master I Handbook, to which we referred some time ago, is intended solely for the use of pilots of the Master. Arrangements have been made for copies to be issued to pilots through their own units only, and supplies do not permit issue to individuals.

Link Trainer Instructors

THE Air Ministry is anxious to obtain the services of men as Link Trainer Instructors. Ex-flying instructors are ideal, but pilots with 50 hours' flying will be considered. The rank offered is Sergeant, Group 1, and the pay is 9s. 6d. per day, plus accommodation and messing allowance. Applications should be sent to Squadron Leader D. F. Macdonald, Air Ministry, London.

"Nailed to the Mast"

CAPTAIN J. LAURENCE PRITCHARD, Secretary of the Royal Aeronautical Society, has written to the Editor and offered the suggestion that flags should be hoisted now on every public building throughout the British Empire, and on every private flag pole in every town and in every village, and that they should be nailed to the mast. Well, why not? It would be a symbol, constantly visible, of the spirit of the Empire.

Goods by Road

ALL who have occasion to send goods by road, especially those who may be experiencing difficulty at present, will do well to obtain a copy of the July issue of "Goods Road Services Guide," an invaluable bi-yearly publication issued by our contemporary, *Motor Transport*. Details are given of no fewer than 1,300 regular long-distance goods services, as well as hundreds of intermediate towns served by these services. A list of clearing houses precedes each section of the guide and there is a comprehensive index covering every sizeable town in the country. Particulars are also included of machinery carriers, and tank waggon operators. The price is 6d., or by post 9d., and copies may be obtained from the publishers, Iliffe and Sons Ltd., Dorset House, Stamford Street, London, S.E.1.

THE EAGERLY-AWAITED MOMENT. Volunteers at an Initial Training Wing receive their kit. They will be trained as pilots, observers, wireless operators and air gunners.

Air Raids

THE little booklet issued by the Ministry of Home Security on what you must know and what you must do in air raids tells the householder all about precautions, shelters, fire-fighting, gas protection and so forth. At 3d. it is marvellous value and well worth getting. Copies can be obtained through newsagents, or direct from the Stationery Office, Kingsway, London, W.C.2. In the latter case 1d. should be added for postage.

French Air Mails Suspended

THE Postmaster General announces that the French air service by the direct route to South America and the French air services to North Africa, West Africa and French Indo-China, by which air mail from this country has hitherto been forwarded, have been suspended. Air mail for all South American countries will continue to be accepted for transmission, either by the North Atlantic air service or by surface route to New York, and thence in each case by air.

British Overseas Airways

THOUGH for ten months war has been raging, it has not stopped for a single day the activities of British commercial flying on the overseas routes.

While north-east France was being invaded, British Overseas Airways' air liners flew daily between London and Paris; when the French capital fell to the Germans the same aeroplanes continued to operate, Tours being their terminus in France. As the time drew near for Italy to enter the conflict, the Empire flying-boats were routed so as not to call at Italian ports. As a result, on the day that Mussolini threw in his lot with Hitler, not one British flying-boat was over Italian territory.

And so with the British air service to Lisbon—an important link between Britain, the United States, Canada and South America. This route, via Bordeaux, was used until the Germans had practically engulfed France. On the day after the suspension of this service, a flying-boat made a direct flight from Britain to Lisbon, carrying passengers and mail to be transferred to the Pan American Clipper service across the Atlantic.

On the same day a revised Empire route began to operate in order to maintain air communication between South Africa, India, Australia and New Zealand. Thus, with the continued, but necessarily irregular, flights to Lisbon and the links with the United States and Canada, and from U.S. to New Zealand and Australia, every important part of the British Empire is kept on an air route.

Staff of B.O.A.C.

IN reply to a parliamentary question, Captain Balfour stated that the total number of staff employed by British Overseas Airways Corporation on May 31, 1940, was 5,213. This total includes 300 engineers and supervisory staff wholly employed on work for the Royal Air Force and the Ministry of Aircraft Production.

Record Figures

LAST week-end the Minister for Aircraft Production, Lord Beaverbrook, announced that the output of aircraft and aero engines last month was more than twice the corresponding figure for June, 1939. He also discloesd that orders placed in the United States now total well over a thousand million dollars, while Canadian orders amount to more than fifty million dollars. There are still ways in which output at home can be speeded up, and readers are referred to the leader on p. 19 for one instance.

A Mythological Phenomenon

A REPORT has been received by the Bristol company recently from New Guinea, in which reference is made to the excellent service which is still being given by the Bristol Jupiter engines used for air transport between Wau and Salamaua. It may be recalled that the Jupiter has not been in production since 1928, and that when these particular engines were purchased they were already second-hand. Since then they have been operated under very strenuous conditions, and with little expenditure on spare parts. No wonder, with an ancestry like that, that the modern Bristols, whether poppet- or sleeve-valve types, are giving such a fine account of themselves.

ANODISING

An Outline of the Processes Available for the Anodic Oxidation of Aluminium and Its Alloys

Illustrated by "Flight" photos

Mr. J. M. Perfect, the author of this article, in his laboratory.

SO many new firms have come into the aircraft industry that we have thought the following notes, prepared by an expert in the subject, useful in giving those of them which are not too clear in their own minds about the basic nature of anodising an idea of "what it is all about." The following article is intended purely as a guide to newcomers to the industry, and has not been written with the idea of appealing to those already familiar with the three main processes in use in this country.. Thus the author confines himself to the general aspects of the processes, and points to some of the difficulties which may beset beginners.—ED.

All the processes for the anodic oxidation of aluminium and its alloys work basically in the same manner, although the details vary considerably. In all cases the aluminium or alloy to be treated is made the anode in an electrolytic cell, and a current is passed through the cell for a certain period. The water in the electrolyte is split up into hydrogen and oxygen in the normal way. The hydrogen is evolved at the cathode (usually the sides of the cell or bath used), and the oxygen makes its appearance at the anode. Some very small quantities of oxygen are evolved there and pass away as bubbles, but the bulk of it combines with the surface of the aluminium to form a dense, microscopically porous and highly adherent layer of aluminium oxide.

This layer constitutes the anodic film, and protects the surface of the metal from further attack by air or other atmospheric influences. As it is formed from the metal itself and, as it were, grown into the crystal lattice of the metal, it is so adherent that it is impossible to remove the film intact from the surface of the metal. Films have been detached and examined, but only by destruction of the base metal, usually by treatment at a high temperature with dry hydrogen chloride, when the aluminium combines to produce aluminium chloride which, at the high temperatures used, is in the form of vapour and may be distilled away and sublimed. Examination of such films shows them to vary in thickness from .0003in. to .00075in., and to be principally composed of aluminium oxide, together with salts derived from the electrolyte used.

There are three main groups of processes:—

The Bengough-Stuart Process

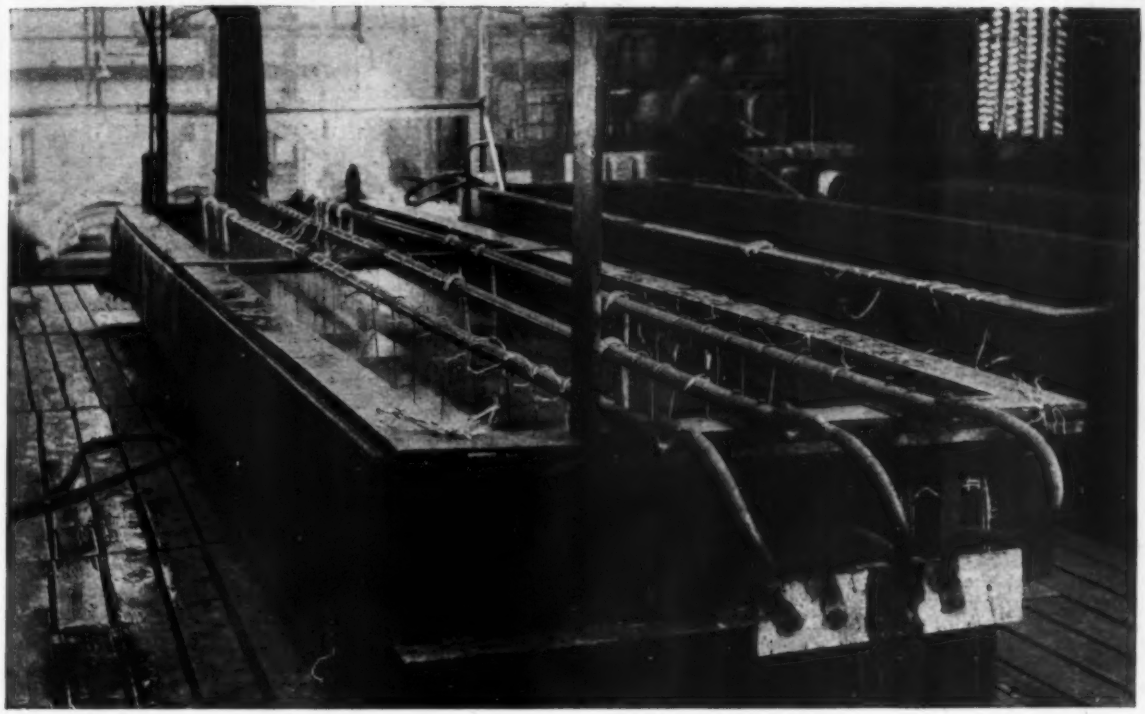
This was the first process to be commercially applied, and was invented by Messrs. Bengough and Stuart, working in the N.P.L. Laboratories. It was patented in 1923, and for a considerable time was specified for anti-corrosive treatment of all aircraft parts. The value of the pioneer work done by Bengough and Stuart is shown by the fact that the process has barely been modified in any way from their original specifications, despite numerous attempts at improvement and simplification; and even to-day the majority of aircraft parts are treated by this process.

Use is made, in this process, of a 3 per cent. solution of chromic acid at 40 deg. C. ± 2 deg. C., as electrolyte, and produces good results on most alloys, although those alloys containing high percentages of copper, magnesium or zinc tend to show pitting after the process. In alloys which have been subjected to heat-treatment without sufficient care, segregation may take place of the alloying constituents, and in such cases dangerous weakening may well occur owing to the attack of the chromic acid producing porosity.

The process takes 60 minutes, during which time the voltage across the electrodes of the vat is varied in a somewhat complicated manner. It is raised in stages of 2 to 3 volts from 0-40 volts during the first quarter-hour of treatment; it is then maintained at 40 volts for 35 minutes, raised during the next five minutes to 50 volts, and maintained at this voltage for a further five minutes. Because of this complicated changing of the potential the process must be worked in batches. This is a disadvantage in preventing a smooth flow of work, although it ensures that all parts do receive full treatment.

The film produced varies from opaque grey-white to dark grey in colour, and is highly absorbent of dyes or greases when newly formed. The property of dye absorption is used as a test of the film in the well-known indelible pencil test. Owing to the absorptive properties, the film should be kept scrupulously clean after formation, or it will acquire unsightly blemishes and stains due to absorption of dirty fluids or greases with which it may come in contact.

The colour of the film varies with the alloy treated. On pure aluminium in a newly made bath a beautiful pearly grey-white colour is produced, but this is rarely seen in commercial practice, as slight impurities in the metal and



One of the 25ft. tanks in use at the works of British Anodising, Ltd.

unavoidable pollution of the baths mitigate against its appearance. With increasing quantities of alloyed metals the film progressively darkens, until the L.33 13 per cent. silicon alloy appears a dark purplish grey. Impurities in the metal surface, such as non-metallic inclusions, or surface defects such as porosity, flaking, lamination, blistering or fissures are all more clearly visible after anodising than before. Fissures and porous portions are characterised by a yellow to brown staining round the defect, caused by inclusion of chromic acid in the fissures or pores, which seeps out afterwards and is absorbed in the anodic film. Similar staining may be seen round deep narrow folds or crevices, or round riveted parts. The staining itself has no deleterious effect on the anodic film, although it is unsightly and to be avoided by adequate washing where possible. Its appearance should, however, always be closely noticed, as it will often show up imperceptible defects in the metal which might otherwise pass unnoticed until failure took place under stress.

Details of the tests to be made on the formed films, and instructions for the testing and upkeep of the electrolyte, are contained in the relative A.M. Specification DTD.910A. It may be noted that very generous latitude is given in this specification of the degree to which baths may be exhausted before renewal. It is rarely possible to exhaust them to the limits allowed by the specification and produce good results. The best test is the result obtained; if the total quantity of acid allowable has been added, and good results are not obtained, it is best to discard the bath and make up a new one, even if titration still shows the bath to be well above the minimum strength allowable. All the instruments used (ammeter, voltmeter and thermometer) should be carefully checked from time to time, as should also the electrical connections to the bath. Failure or erratic behaviour of one of these instruments can produce very misleading results. Dial thermometers, in particular, should always be regarded with suspicion and regularly checked against a standard mercury thermometer.

Sulphuric Acid Processes

There are a number of such processes worked in which the electrolyte consists mainly of a solution of sulphuric acid plus a variety of additions. They are all worked in a similar manner, and here it is proposed to describe the Sheppard process as a typical example. This process was patented in 1930 by S. R. Sheppard, and is worked by British Anodising, Ltd., Anodising and Platings, Ltd., and, prior to the German occupation of Holland, by N. V. Nederlandsche Anodising Maatschappij, of The Hague. It was the first sulphuric acid process to be given full approval by the Air Ministry for the treatment of all aircraft parts, which approval was obtained in 1936 after exhaustive tests had been carried out over a period of two years by the Air Ministry. The tests performed not only concerned the anti-corrosive properties of the film, but the effect of anodising on such properties as the fatigue resistance, tensile strength, proof stress and deformation tests.

The electrolyte used consists of 30 per cent. sulphuric acid plus the addition of up to 10 per cent. of glycerine, and the patent covers the use of all alcohols, aldehydes and ketones as addition agents.

In common with all other sulphuric acid processes, no variation of the potential applied during treatment is required. A potential of from 10 to 12 volts is used, this varying between these limits according to the alloy under treatment, the object of such variation being to produce an equal current density of approximately 12 amp/sq. ft. on all alloys. Further variation is obtained by varying the temperature between 15 and 20 deg. C. When satisfactory conditions for a particular alloy have been ascertained, rigid control of the applied voltage and temperature must be maintained, the allowable variation for temperature being only ± 0.5 deg. C.

Full protection is obtained on most materials after 40 minutes' treatment, but for certain special purposes this period may be shortened, or increased up to a maximum of 70 minutes.

The baths used are lead lined to resist the action of the sulphuric acid, and this lining serves as the cathode, being protected from accidental short-circuits by a lining of loose glass plates. Protection against current leakage from the anode rails on which the work is hung must be provided by suitable insulation, but such protection is very simple to obtain at such a low voltage.

The process produces good results on almost all alloys of aluminium. On the more difficult ones (containing

large percentages of copper, magnesium or zinc) the degree of metal solution during treatment is less than by any other process. Hence, such alloys as those which pit in other processes may be treated by the Sheppard process to produce a fine smooth finish. This is particularly useful when parts with fine-cut threads must be treated, and such parts made, for example, from R.R.66 alloy should be specified for sulphuric acid treatment.

The film produced on most alloys and on pure aluminium is of an almost colourless glassy nature and does not greatly alter the appearance of the metal from that before treatment. Polished metal retains almost all its lustre, provided its surface is of a homogeneous nature. An exception is the group of silicon alloys. These progressively darken with increase in percentage of silicon, until L.33 anodises to a dark purple grey. Even 1-2 per cent. of silicon will produce a dullisn grey effect somewhat similar to pewter.

The film when first produced is very highly absorbent and of very even texture, and it is on films produced by sulphuric acid treatment that the greatest success has been obtained in the production of coloured finishes by dyeing.

One interesting application of the sulphuric acid process is the treatment of pistons of internal-combustion engines. The pistons, after anodising, are sealed in hot lubricating oil; absorption of the oil takes place, and the oil film so produced has very great resistance to removal. Even extraction with hot organic solvents will not remove it completely. Such anodising and impregnation has been shown to prevent dry starting, as the oil film on the piston operates until the lubricating system comes into play. Other improvements noticed are a reduction of scoring on the piston and cylinder wall, and a reduction of ring groove wear.

The anodic film as formed has a high insulation value, and on water sealed sulphuric acid films will often withstand an applied potential of 500 v.

Oxalic Acid Processes

These can only be briefly touched on here, as they are not operated in this country, and so are only of academic interest.

The principal process is the Eloxal process, used extensively in Germany. It employs a 5 per cent. solution of oxalic acid at a temperature of from 20-35 deg. C., and an applied voltage of 40-60 volts. Either D.C. or A.C. may be used, and according to one process a D.C. current is superimposed on an A.C. current. This effect is obtained by a very complicated electrical circuit, but especially flexible films are claimed to be produced suitable for insulation of wires, or for the anodising of sheets prior to shallow pressing or drawing processes.

Packing rivets into containers for submersion in the anodising bath. On removal from the bath the rivets are stained for identification.

Small components are wired together to provide the necessary electrical contact.

These films can be coloured and sealed in a similar way to those produced by sulphuric acid processes, and those obtained by the use of A.C. at low temperatures are of a yellow to bronze shade when produced.

Some notes on the limitations of anodising may also be of value. It is impossible to anodise any other metal than aluminium or its alloys; most other metals in contact with aluminium undergoing anodic oxidation are dissolved. Hence, it is impossible to treat composite parts embodying other metals than aluminium. For example, an aluminium wheel with a cast-in bronze bush cannot be anodised as the bush would be destroyed.

For decorative finishes the metal used must be as perfect as possible, as all defects will be accentuated by anodising. Castings for the purpose are best gravity die cast, as the close-grained structure due to the rapid cooling of the surface produces a much more even crystal structure which, even if revealed by the anodising, is not unpleasant in appearance.

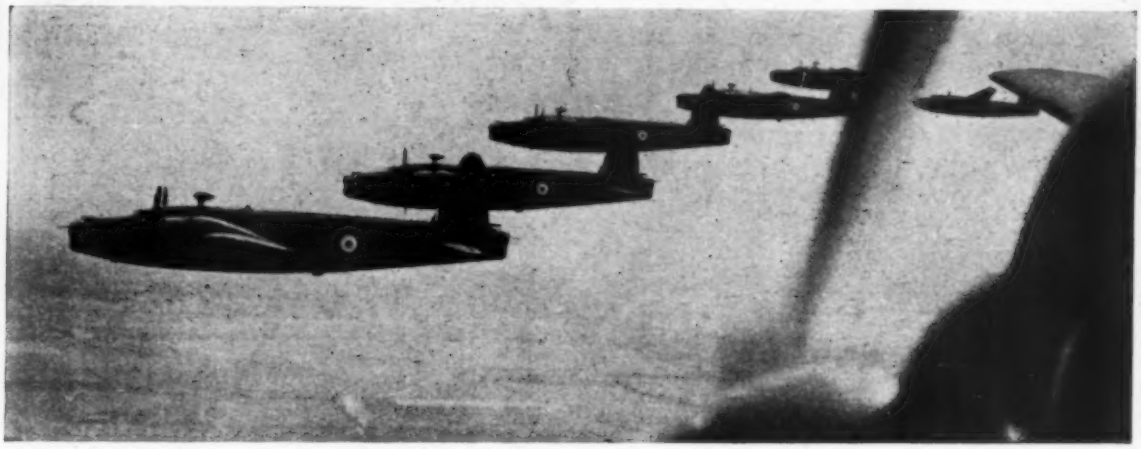
Pressure die castings anodise well, but usually contain a large percentage of silicon, and in consequence can only be dyed black.

Alloys containing more than 10 per cent. of copper, 5 per cent. of zinc or 5 per cent. of magnesium are very prone to pit during anodising and should be avoided where possible.

Secondary alloys produced from remelted scrap are also to be avoided, as quite large quantities of brass frequently find their way into the remelted scrap and produce unwanted and unknown amounts of zinc and copper in the alloys.

Deep crevices should be avoided, as it is very difficult to wash out the electrolyte from such places, and for the same reason it is preferable to anodise assemblies in their component parts wherever possible.

SERVICE AVIATION



A New Zealand Bomber Squadron flying their Wellingtons in "echelon stepped up."

Royal Air Force Official Announcements

H.M. the King's Birthday

HIS MAJESTY THE KING has been graciously pleased to send the following reply to a loyal message of congratulation from the Royal Air Force:—

"I sincerely thank all ranks of the Royal Air Force for their loyal message of good wishes on the occasion of the celebration of my birthday.

GEORGE R.I."

The text of the message to His Majesty the King was as follows:—

"All ranks of the Royal Air Force wish to tender with humble duty an expression of their unfailing devotion in your Majesty's service and their warmest congratulations and loyal good wishes on Your Majesty's birthday."

Empire Recruiting and Training

MR. POWER, Canadian Minister for Air, in a statement to the House of Commons in Ottawa, said that since September 15, 25,000 recruits had passed their medical and other tests and 13,000 officers and men had been enlisted. Since the acceleration of the training programme a month ago, men had been enlisted at the rate of 1,000 a week.

Making Use of Experience

SIR ARCHIBALD SINCLAIR, Air Minister, has appointed a committee under the chairmanship of Air Chief Marshal Sir Robert Brooke-Popham, G.C.V.O., K.C.B., C.M.G., D.S.O., A.F.C., late Governor of Kenya, to interview officers and airmen who have been in action against the enemy, in order to discover any useful suggestions which they may have to make as a result of their experience, and make such suggestions generally known throughout the R.A.F.

Uniform for Special Duties

A SPECIAL duties uniform for wear by certain civilian officials has been approved. It follows the standard R.A.F. service dress in material suitable to the status of the individual. No R.A.F. badges or insignia will be worn and button and buckle coverings are to be brown leather. An armlet in light blue and dark blue alternate horizontal stripes with the letters "S.D." 2in. high will be worn above the elbow of the right arm. Authority to wear this uniform must be obtained in each case from the Air Ministry.

Vacancies for Civilian Pilots

COMMISSIONS are still available in the Royal Air Force for qualified pilots who are normally beyond the age of acceptance for flying duties. They are required for duty as pilots of aircraft in non-operational work such as flying instructors, ferry pilots, pilots of aircraft employed in the training of air observers, wireless telegraph operators and air gunners, etc.

Hitherto, applicants, who must be between the ages of 23 and 48, have been required to have carried out at least 200 hours solo flying, including recent experience on modern types of aircraft. Preferably, they should be holders of Class "B" Pilots Licences. The Air Ministry has now decided to reduce the required number of hours of solo flying from 200 to 150.

Appointments will be in the rank of Pilot Officer, with pay of 14s. 6d. a day and allowances, with the opportunity of promotion to Flying Officer (18s. 2d. per day) and Flight Lieutenant (£1 1s. 9d. per day).

Forms of application may be obtained from the Air Ministry (S.7.e.(5)), Adastral House, Kingsway, London, W.C.2.

Anti-Aircraft Awards

TWO officers, Lieutenants N. Bradbury and R. Bilton, both of the Royal Artillery, have each been awarded the Military Cross in recognition of their excellent work with the A.A. guns. The troop under Lt. Bradbury accounted for 22 known enemy machines destroyed and Lt. Bilton's troop's score was 18 aircraft.

R.A.F. Thanks Girl Guides

THE Secretary of State for Air, Sir Archibald Sinclair, has expressed to Mrs. St. John Atkinson, Chief Commissioner of the Girl Guides Association, the gratitude of the Royal Air Force for a gift of £15,000 from the Girl Guides of the Empire. The money is to be used to buy and equip two air ambulances. It is part of £46,216 raised by the Guides in less than two months. They were asked to give up half a day's pay and the response has been generous and enthusiastic beyond all expectations.

The aircraft will be the first air ambulances specially constructed for the R.A.F. in this war. Hitherto converted troop-carrying aircraft have been used for this purpose.

The ambulances will be standard Airspeed Oxford aircraft with a specially fitted body. Inside the ambulances accommodation will be provided for two stretchers and two sitting cases, or four sitting patients. There will be room, also, for a wireless operator, or an attendant in addition to the pilot. The aircraft will have lavatory and washing accommodation, and will carry emergency surgical equipment.

Air Member of Council for Training

AIR VICE-MARSHAL A. G. R. GARROD, O.B.E., M.C., D.F.C., has been appointed an Air Member of the Air Council for Training. All departments of the Air Ministry which deal with training, both air crew training and technical training, will be his responsibility. He will also deal with the relation of training in this country to the Empire scheme.

Air Vice-Marshal Garrod was born in 1891 and was educated at Bradfield and Oxford. In 1914 he was commissioned in the Leicestershire Regiment and next year won the Military Cross. In October, 1915, he was seconded to the Royal Flying Corps, and later qualified as an instructor. In June, 1919, he was awarded the Distinguished Flying Cross. In the inter-war years he passed through the Naval Staff Course, was an instructor at the R.A.F. Staff College, and was Chief Instructor to the air squadron of his own university, served in Iraq, passed through the Imperial Defence College, and in 1938 became Deputy Dirtctor-General of Equipment at the Air Ministry.

Observer Corps Uniform

APPROVAL has been given for the introduction of a uniform to be worn by the personnel of the Observer Corps. For officers the standard R.A.F. service dress will be worn but devoid of any R.A.F. badges or other insignia. Observer Corps gilt badges and buttons will be worn and a band 1½in. black braid on the cuff to denote officer status irrespective of rank. A band of black braid will also be worn on the greatcoat shoulder straps. An armlet 2in. wide, ¼in. blue and ⅜in. white alternate vertical stripes, with "Observer Corps" embroidered in ½in. red letters is to be worn above the elbow on the left arm. Other ranks will wear a dark blue combination suit over plain clothes and a dark blue beret bearing the Observer Corps badge. Armlet as for officers will also be worn.

Awards

HIS MAJESTY THE KING has been graciously pleased to approve of the following Awards:

THE MEDAL OF THE MILITARY DIVISION OF THE MOST EXCELLENT ORDER OF THE BRITISH EMPIRE FOR GALLANTRY.

CAMPION, LEADING AIRCRAFTMAN MICHAEL. FROST, AIRCRAFTMAN FIRST CLASS ERNEST RALPH CLYDE.

These two airmen displayed great courage in effecting the rescue of an unconscious pilot from a burning aircraft which resulted from a collision in which two Blenheim aircraft were involved while taking off.

Aircraftmen Campion and Frost were among the first to arrive on the scene. Not knowing that the pilot was the sole occupant, Aircraftman Frost promptly entered the rear cockpit, which was full of smoke and fumes, in search of the wireless operator.

Satisfying himself that no one was there, he climbed out, and, nearly exhausted, ran to the front cockpit, where Leading Aircraftman Campion was trying to rescue the pilot. Working heroically, both men, with great risk to themselves, due to the imminent danger of the petrol tanks exploding, extricated the pilot from the burning wreckage. Shortly afterwards the tanks exploded and the whole aircraft was rapidly burned out. Unfortunately the pilot died later.

DISTINGUISHED FLYING CROSS.

AITKEN, SQUADRON LEADER THE HONOURABLE MAXWELL, AUXILIARY AIR FORCE.

In May, 1940, whilst leading a section of aircraft on patrol over Brussels, this officer attacked one of twelve Heinkel 111s, which was finally seen to be losing height with one of its wings on

Service Aviation

fire and with black smoke pouring from the other. The next day, when leading his section on another patrol, a large number of Heinkel 111 and Junkers 87 aircraft, escorted by Messerschmitt 110s, were sighted. Squadron Leader Aitken attacked and succeeded in destroying one Heinkel and one Junkers aircraft. During a night in June, 1940, in difficult circumstances, he destroyed yet another enemy aircraft. He has displayed great dash and gallantry.

DISTINGUISHED FLYING MEDAL.

FRANKLIN, Flight Sergeant William Henry.

During a period of six days in May, 1940, Flight Sergeant Franklin took part in numerous offensive patrols over Northern France, and on eight occasions was in combat with the enemy. He has himself shot down one Junkers and two Messerschmitt aircraft and in company with his section he has destroyed three other enemy aircraft. One day in June, 1940, in company with his squadron, Flight Sergeant Franklin engaged fifteen to twenty Messerschmitt 109s and destroyed two. Throughout these engagements he has shown great skill, courage and determination in pressing home his attacks. On one occasion he chased an enemy aircraft more than 20 miles, almost at ground level, before destroying it.

Roll of Honour

Air Ministry Casualty Communique No. 37.

THE Air Ministry regrets to announce the following casualties on various dates. The next of kin have been informed.

KILLED IN ACTION (WHILE FLYING IN OPERATIONS AGAINST THE ENEMY).—Clarke (546660), Sgt. P. F.; Green (580173), Sgt. R. L.; King-Clark (41429), P/O. C.; Little (562340), Cpl. D.; Smith (39692), F/O. H. V.; Vagg (70825), P/O. E. A.

PREVIOUSLY REPORTED "MISSING, BELIEVED KILLED IN ACTION," NOW PRESUMED "KILLED IN ACTION."—Wallace (550802), L.A/C. A. V.

PREVIOUSLY REPORTED "MISSING," NOW PRESUMED "KILLED IN ACTION."—Kane (543862), Cpl. D. D.; Lewis (519767), A/C.1 J. C.; Page (565335), Sgt. T. E.; Saffin (534026), L.A/C. A. J.; Shaw (40571), P/O. W.; Shute (32020), Sqn. Ldr. F. W. C.; Sinclair (37428), Acting Flt. Lt. J. M. H.

PREVIOUSLY REPORTED "MISSING BELIEVED KILLED IN ACTION," NOW REPORTED "KILLED IN ACTION."—Campbell-Irons (40603), P/O. I.; Greet (580696), Sgt. J.

PREVIOUSLY REPORTED "MISSING," NOW REPORTED "KILLED IN ACTION."—Dockrill (563473), Sgt. C. J. E.; Dormer (563966), Sgt. P. F.; Gregory (551303), A/C.1 K. G.; Jennings (580427), Sgt. C. M.; McPhail (581156), Sgt. I.; Palmer (551629), L.A/C. W. E.; Ratford (41951), P/O. F. W.; Thompson (90287) F/O. M. H. B.

WOUNDED OR INJURED IN ACTION.—Baker (627104), Sgt. B. C.; Brown (545605), Sgt. K. V.; Eames (70196), F/O. P. F.; Eyton-Williams (78528), P/O. R.; Hives (625698), Sgt. S. A.; Morant (33504), P/O. R. A. L.; Price (520838), Sgt. H. W.; Quinn (611465), Sgt. E. S.; Rowe (536699), Sgt. B. J.; Rudd (565423), Sgt. T. H.; Shorthouse (36251), P/O. J. S.; Summerson (568963), L.A/C. A. K.; Utteridge (536916), L.A/C. R. J.; Wallace (581046), Sgt. A. F.

PREVIOUSLY REPORTED "MISSING," NOW REPORTED "WOUNDED OR INJURED IN ACTION."—Fisher (36152) P/O. R. Ber P.

DIED OF WOUNDS OR INJURIES RECEIVED IN ACTION.—Anthony (40655), P/O. D. N. W. L.; Hollister (561153), Sgt. W. F. G.

MISSING, BELIEVED KILLED IN ACTION.—Hawkins (70802), F/O. R.; Hugill (43422), P/O. F.; Wilkie (42170), P/O. J. L.

MISSING.—Adams (525865), Sgt. P. E. F.; Baker (563729), Sgt. B. T. M.; Barrett (37078), Flt. Lt. D. M.; Barrett (580566), Sgt. W. J., D.F.M.; Barrie Smith (39178), F/O. W.; Bates (567448), Cpl. W. J.; Baynes (42479), P/O. R.; Beauclair (40493), P/O. D. A.; Beddington (523009), Sgt. J. P.; Bowen (333761), L.A/C. F. G.; Brennan (549506), Sgt. K. B.; Burran (552645), Sgt. C. A. C.; Burt (542020), L.A/C. C. S.; Butler (76576), P/O. F. C. J.; Butler (42103), P/O. M. A.; Campbell (743031), Acting Sgt. D. F. S.; Cargill (43197), P/O. A. S. T.; Collins (9193), L.A/C. L. F.; Cory (564105), Flt. Sgt. P. G.; Cotterell (580948), Sgt. N. C.; Cumpstey (542049), Sgt. H. G.; Curzon (70156), F/O. R. K.; Dale (508348), Cpl. F.; Dobson (547354), L.A/C. J.; Donnelly (541074), A/C.1 N. P.; Dunt (581148), Sgt. D. H.; Elliott (740509), Sgt. R. G.; Ellis (563097), Sgt. R. G. D.; Egson (40376), P/O. S. G.; Feeny (32076), Sqn. Ldr. D. Y.; Fennell (531039), Sgt. C. F.; Frost (42342), P/O. C. D.; Gaylard (41995), P/O. P. C.; Gibbons (353056), Cpl. F. C.; Grant (536339), L.A/C. L. O.; Hamblett (563152), Sgt. S.; Harfitt (250786), L.A/C. H.; Herriot (580956), Sgt. N. B.; Hill (42004), P/O. A. J.; Holmes (633325), Sgt. H. R.; Hughes (580302), Sgt. H. C.; Hunter (40710), P/O. D. G.; Jannaway (533931), Cpl. R. H.; Jolliffe (509040), L.A/C. A. H. E.; Jolliffe (33263), Flt. Lt. P. C.; Kendall (563359), Sgt. G. W. H.; Kenyon (581396), Sgt. H.; Kinghan (535306), Sgt. F. G.; Legg (902217), Sgt. A. T.; Lloyd (90569), P/O. J. R.; Longstaff (755125), Sgt. S.; McCulloch (901582), Sgt. I. M.; Macdonald (552525), A/C.1 D. A.; Mapletoft (566419), Sgt. M. V.; Matheson (41722), P/O. C.; Millner (580106), Sgt. W.; Mitchell (812090), L.A/C. G. A.; Mitchell (41862), P/O. J. G.; Morris (528047), Sgt. A. R.; Murchison (967455), Sgt. G. R.; Naylor (581407), Sgt. C.; Neary (522356), Sgt. C. H.; Nicholson (41052), P/O. J. H.; Norfolk (751127), Sgt. A. B.; Owen (359616), Sgt. H. J.; Parkhouse (33575), P/O. R. C. L.; Pepper (627043), A/C.1 L. V.; Pittar (580624), Sgt. W. D. P.; Plant (40458), P/O. J.; Powell (614266), Sgt. R. S.; Prescott (740264), Sgt. T. C.; Price (626267), Sgt. J.; Richmond (350828), L.A/C. H. V.; Robinson (633727); A/C.1 W.; Rowcliffe (631427), Sgt. W. S.; Royle (518637), Cpl. W. C.; Schofield (550273), Sgt. R. R.; Smith (40187), P/O. A. S.; Smith (613537), L.A/C. F.; Smith (37214), Flt. Lt. J. B. W.; Sparks (754915), Sgt. N. J.; Stephens (40028), Flt. Lt. J. W.; Stuart (70654), F/O. A. J.; Swallow (540806), Sgt. V. J.; Taylor (40443), P/O. B. A.; Tozer (77983), P/O. J. J.; Trowbridge (550858), Sgt. R. C.; Walker (39803), F/O. G. E.; Wallis (39180), F/O. C. A.; Walton (568459); Sgt. G. W. E.; Webster (631464), Sgt. C. N.; Weeks (37534), A.Flt. Lt. R. A.; Weightman (533027), Sgt. P. W.; Wicks (751253), Sgt. J. D.; Williamson (37370), Flt. Lt. A. E.; Wilson (519827), Sgt. C. G. M.

MISSING, BELIEVED KILLED ON ACTIVE SERVICE (while engaged in non-operational flying duties or on the ground through enemy action).—Anderson (743074), Acting Sgt. F. L.; Barratt (79087), P/O. F. A.; Henderson (748484), Sgt. W.

KILLED ON ACTIVE SERVICE.—Beardon (74663), P/O. G. D. H.; Cotton (745062), Sgt. C. F.; Godfray (525013), L.A/C. R. P.; Goodwin (90504), P/O. B. L.; Hazel (517158), Sgt. C. B.; Hodgson (314444), A.F/O. R. C.; Keeble (41711), P/O. E. J.; Pascoe (740424), Sgt. E. W.; Ross (625019), Sgt. J. P.; Smith (748315), Sgt. L. C.; Speir (580985), Sgt. W. R.; Tait (565362), Sgt. C. J. W.; Thompson (569158), L.A/C. M. D. J.; Ward (534379), L.A/C. H. R.; Wood (530332), L.A/C. F. R.

WOUNDED OR INJURED ON ACTIVE SERVICE.—Birbeck (910260), A/C.2 A. J.; Farrow (901170), L.A/C. L. E.; Haselden (741905), Sgt. J. H.; Hindmarsh (77964), P/O. P. E.; Jameson (37813), Acting Flt. Lt. P. G.; Lightfoot (551530), A/C.1 L. H.; Swan (74728), P/O. L.

DIED OF WOUNDS OR INJURIES RECEIVED ON ACTIVE SERVICE.—Main (632772), A/C.2 G.

DIED ON ACTIVE SERVICE.—Brown (996318), A/C.2 C. W.; Graham (971771), A/C.2 T. W.; Heard (885746), A/C.2 G. M.; Holloway (543802), A/C.1 P.; Jackson (74142), Acting Flt. Lt. V. E.; James (366128), Warrant Officer H. A.; Jones (524515), L.A/C. J. T.; McGrady (630150), AC.1 N.; McLean (614699), A/C.2 C. M.; Moran (533080), L.A/C. F.; Smith (521231), Cpl. H. E. G.; Swarbrick (978065), A/C.2 J.; Williams (883075), A/C.2 B. S. W.; Wilson (992227), A/C.2 W.; Wood (31043), Sqn. Ldr. H.

PREVIOUSLY REPORTED "MISSING," BELIEVED "KILLED IN ACTION," NOW REPORTED "SAFE."—Wood (33448), P/O J. E. R.

PREVIOUSLY REPORTED "MISSING, BELIEVED KILLED IN ACTION," NOW REPORTED "PRISONER OF WAR."—Dixon (533999), Cpl. G. H.; Pennington (42146), P/O. E. D.; Herrick (70899), Acting Flt. Lt. R.

PREVIOUSLY REPORTED "MISSING," NOW REPORTED "PRISONER OF WAR."—Atkinson (580557), Sgt. G.; Clarke (617362), A/C.2 L. R.; Corrigan (580641), Sgt. E. P.; Davies (627554), A/C.2 W. E. M.; Edmondson (543850), L.A/C. D. S.; Falkus (41004), P/O. H. E. L.; Harper (563534), Sgt. N. T. W.; Hart (580370), Sgt. C. S.; Havgreen (517848), Sgt. A. J.; Hoare (39384), F/O. D. S.; Houston (745977), Sgt. J.; Hulton-Harrop (41585), P/O. C. P. L.; Imprie (40711), P/O. A. M.; James (42232), P/O. B. A.; Lockett (41038), P/O. P. V.; McIntosh (40631), P/O. I. A.; Macnaughton (535858), L.A/C. R. P.; Macpherson (42141), P/O. R. I. C.; Murray (41051), P/O. H. M.; Oliver (580873), Sgt. M. A.; Paddon (28097), Sqn. Ldr. B.; Pumphrey (90284), F/O. R. E. W.; Roberts (40140), F/O. A. C.; Slade (616565), A/C.1 W. G.; Smalley (580626), Sgt. M. D.; Smith (621323), A/C.2 G. B.; Stapleton (41078), P/O. W.; Thorpe (523426), Sgt. G.; Turner (26216), Sqn. Ldr. W. H. N.; Ward (516975), Sgt. E. H.; Ward (542939), A/C.1 J. G.; Winkler (564597), Sgt. H. R. W.

London Gazette

ROYAL AIR FORCE

General Duties Branch.

The undermentioned are granted commissions for the duration of hostilities as Pilot Officers on probation. (April 1):—Flt. Sgt.: T. Atherton. Sgt.: J. V. Moore.

The undermentioned Acting Pilot Officers on probation are graded as Pilot Officers on probation with effect from the dates stated and confirmed in their appointments May 1:—(April 10) A. C. Cochrane; (April 20) G. M. Howard-Jones.

The undermentioned Acting Pilot Officers on probation are graded as Pilot Officers on probation on the dates stated:—(March 24) N. R. Peel; M. R. MacClancy; (May 11) D. C. Leary; (May 15) S. N. Stirk; (May 18) G. R. Holyoke; J. K. Punshon; W. H. Dimmock; J. J. Finlay; J. K. M. Cooke; A. K. Jackson; J. J. P. Kenny; H. W. E. Lane; J. E. P. Laricheliere; W. S. Longhurst; E. O. Richards; I. A. Slaughter; G. M. R. Smith; H. R. Stothard; C. F. Sutcliffe; A. M. Todd; R. A. Ullman; J. F. L. Walker; D. P. Watson; E. L. West; (May 20) K. G. Webb; G. H. A. Wellum; S. C. R. Bell; (May 21) J. A. Milne; L. A. Sears; (May 25) F. Galt de Sieyes; N. D. Sinclair; R. E. Troward; M. White; P. C. Pullen; (June 1) R. P. A. Jules de Burlet; J. Dellow; D. K. Hayes; R. W. Smith.

The undermentioned Flying Officers are promoted to the rank of Flight Lieutenant on the dates stated:—(May 6) D. L. Amalet, D.F.C.; (May 7) F. E. Williamson; J. Foulsham; (May 25) C. D. Tomalin; (May 26) I. A. Fergusson; (June 25) A. R. Putt; E. J. Little; J. A. Richardson.

The undermentioned Pilot Officers are promoted to the rank of Flying Officer on the dates stated:—(September 18, 1939) (Seniority June 18, 1939) P. J. Davies-Cook; (April 16) M. D. Evans; (April 25) G. G. Heathcote; (April 30) R. E. C. J. Beeny; (May 6) R. M. Cox; (May 10) A. M. L. Selby; (May 23) T. B. Goodbody; (May 25) B. P. H. Page; D. A. Dadswell; (May 29) M. A. L. Williams; P. E. Dodson; (June 6) J. P. V. Nicholls; (June 17) D. Salwey; C. Robertson, D.F.C.; M. W. Waddington; D. H. W. Hanson; (June 25) A. W. K. Watson; D. S. Anderson; J. E. Depnant; R. J. Tuffs; J. V. Berggren; R. A. Green.

P/O. R. B. Chassels relinquishes his short service commission on account of ill-health (June 26).

Errata.

In the Gazette of June 11. Notification regarding Lt. K. L. F. Wilson (Cameronians). *For* May 14 *read* May 15.

Technical Branch.

The undermentioned Warrant Officers are granted commissions for the duration of hostilities as Flying Officers on probation with effect from the dates stated and with seniority of March 14:—(April 14) W. T. Richings; (May 23) R. L. St. G. Saunders; (May 29) G. W. J. Cozens; (June 1) G. R. Cowdrey; (June 6) S. E. Hearnden, M.B.E.; (June 11) J. W. Howarth; (June 12) A. H. F. Murphy; (June 14) K. B. J. Randall; F. G. Whiteley.

The undermentioned are granted commissions for the duration of hostilities as Flying Officers on probation with effect from the dates stated, and with seniority of May 9:—Warrant Officers: (June 3) F. W. May; W. H. Warren; (June 7) W. R. Middleton; P. A. Walker; (June 10) E. V. Hibberd; D. G. Lochead; R. J. Standing; (June 11) F. J. Tonkin; (June 12) W. H. Boyes; H. A. Thomas; H. V. Walder; (June 13) C. G. Bircham; A. A. East; (June 17) F. Lowe. Temporary Warrant Officers: (June 3) W. A. Dount; (June 7) J. McP. Adams; (June 8) F. C. Malyon; (June 12) G. D. Deuchars; J. I. Dow; (June 13) W. E. Deverell; F. W. Page; W. W. Smalley; T. G. Thomson; R. E. Wilson; (June 14) G. P. Reese.

The undermentioned Warrant Officers are granted commissions for the duration of hostilities as Flying Officers on probation with effect from the dates stated and with seniority of May 25:—(June 6) W. A. Wargent; (June 12) H. C. Moss; (June 15) A. W. Attrill; W. G. R. Paris.

Flt. Sgt. S. W. Lane is granted a commission for the duration of hostilities as Pilot Officer on probation with effect from June 10 and with seniority of May 16.

Sir Archibald Sinclair, Secretary of State for Air, talking to R.A.F. officers during a recent visit to a Royal Air Force home station.

The undermentioned Flying Officers on probation are confirmed in their appointments on the dates stated:—(June 12) P. Dobbins; J. R. Stone; W. J. Frost; G. F. Cockell; G. W. Goat; R. J. H. Jackson; T. U. Pollitt; C. Osmond; E. F. Pearce; (June 19) R. C. Pearson; A. F. Cave; R. Tibbey; E. H. Webb; (June 23) F. E. Groom; W. K. Richards; J. Raeside.

The undermentioned Flying Officers are promoted to the rank of Flight Lieutenant on the dates stated:—(May 18) C. L. Trevithick; (May 24) (Seniority May 18) J. H. Styles; (May 31) (Seniority May 18) A. D. Rutherford, D.F.M.

Administrative and Special Duties Branch.—The undermentioned are granted commissions for the duration of hostilities as Flying Officers on probation with effect from the dates stated and with seniority of May 2:—Warrant Officers: (June 1) A. H. J. Ayre; L. Cawthorne, D.C.M., M.M.; (June 4) G. E. Walker. Temporary Warrant Officer: (June 5) F. W. Greenoff.

The undermentioned are granted commissions for the duration of hostilities as Pilot Officers on probation with effect from the dates stated and with seniority of April 25:—Flight Sergeants: (June 3) R. Martin; (June 8) W. C. Putt; (June 17) R. H. Russell. Temporary Sergeant: (June 12) E. S. Smith.

Temporary Flt. Sgt. J. H. Maddern is granted a commission for the duration of hostilities as Pilot Officer on probation with effect from May 30 and with seniority of May 2.

Equipment Branch.

The undermentioned Temporary Warrant Officers are granted commissions for the duration of hostilities as Flying Officers on probation with effect from the dates stated and with seniority of May 2:—(June 10) A. F. Jones; (June 14) G. Turnbull.

Temporary Flt. Sgt. M. McLeod is granted a commission for the duration of hostilities as Pilot Officer on probation with effect from June 10 and with seniority of May 2.

The undermentioned Pilot Officers are promoted to the rank of Flying Officer. May 1:—J. S. Wilkinson; D. H. Pollard; M. C. Mainprice.

Flt. Lt. R. C. V. Ash is transferred to the General Duties Branch. October 30, 1939.

The undermentioned Flying Officers are transferred to the Administrative and Special Duties Branch. (Feb. 15)—H. Allsopp; A. Hall.

P/O. M. I. Harrison resigns his commission. (July 1.)

The short service commission of P/O. on probation R. H. Marston is terminated on cessation of duty. (July 1.)

Accountant Branch.

W/O. W. J. A. Bragg is granted a commission for the duration of hostilities as Flying Officer on probation with effect from June 14 and with seniority of June 6.

The undermentioned are granted commissions for the duration of hostilities as Pilot Officers on probation with effect from the dates stated and with seniority of June 6. Flight Sergeants: (June 13) P. W. Davies; (June 15) J. M. Birnie; G. A. Body. Temporary Flight Sergeant: (June 16) E. V. Hambry.

F/O. J. H. G. D. Bugden is promoted to the rank of Flight Lieutenant. (June 14.)

Medical Branch.

F/O. H. S. Samuel, M.R.C.S., L.R.C.P., is promoted to the rank of Flight Lieutenant. (June 5.)

Princess Mary's Royal Air Force Nursing Service

The undermentioned Staff Nurses are promoted to the rank of Sister on the dates stated:—(June 1) Miss S. M. G. Rathbone; (June 5) Miss F. M. Browne; (June 12) Miss I. Jones; Miss A. M. Swain; (June 15) Miss B. M. Macdougall; (June 28) Miss O. M. Osmond.

Royal Air Force Reserve

RESERVE OF AIR FORCE OFFICERS.

General Duties Branch.

F/O. T. W. Campbell is promoted to the rank of Flight Lieutenant. (Sept. 3, 1939.)

Flt. Lt. M. A. Smith is transferred to the Technical Branch. (April 24.)

F/O. H. S. Miles is transferred to the Administrative and Special Duties Branch. (May 19.)

Flt. Lt. B. Hobson, M.B.E., relinquishes his commission in class CC on appointment to a commission in the Royal Air Force Volunteer Reserve. (June 15.)

Administrative and Special Duties Branch.

The undermentioned are transferred to the Technical Branch. (April 24):—Squadron Leader: O. W. Clapp. Flight Lieutenants: R. W. Jackson; H. Preston; L. E. Vine; H. M. Yeatman; D. J. Divett; W. A. E. Featherstone; W. G. Preston, D.F.C.; W. J. Umpleby; H. Walker. Flying Officers: C. C. Gissing; R. J. Hibberd; L. W. Norman; L. D. G. Morrison; A. H. A. C. Cranmer; A. W. Lindsay; C. R. A. Page; H. M. Samuelson; E. M. Steward; C. A. Jamblin; A. Higham; E. C. Boucher; C. J. A. Delany; A. J. Black; H. N. Miller; H. Webb; A. C. P. Westhorpe; W. W. Whitehead; S. Herbert; H. Pering; H. R. Turner; C. Webster; J. H. Gladstone. Pilot Officers: S. W. Rowland; M. H. Duckham.

Medical Branch.

Flt. Lt. C. P. O'Toole, L.R.C.P. & S., relinquishes his commission on account of ill-health. (May 26.)

Royal Air Force Volunteer Reserve

General Duties Branch.

The undermentioned are granted commissions for the duration of hostilities as Pilot Officers on probation on the dates stated:—(June 3) H. Dane; (June 10) J. D. G. Bishop. Sergeants: (May 27) W. G. Dickie; D. G. Gorrie; (June 8) F. N. Cawse; N. H. Corry; W. Cunningham; R. A. De Mancha; (June 15) B. Campbell; J. G. L. Knowles; J. F. Wills; C. H. Hall; W. C. Hartop; N. L. Haworth-Booth; G. Morgan. Leading Aircraftmen: (May 23) F. J. K. Mason; (June 2) B. K. Cooper; W. A. Cooper; (May 5) H. J. Broxup; E. S. Hewson; C. L. N. Johnson; F. Martin; P. N. Negretti; (June 8) R. Johnson; (June 16) R. M. Phillipps; R. Shaw.

P/O. on probation J. G. Walker is confirmed in his appointment. (Mar. 29.)

The undermentioned Acting Pilot Officers on probation are graded as Pilot Officers on probation on the dates stated:—(May 15) P. Geen; (May 18) I. White; E. S. I. Hallows; (May 29) M. C. Corner; C. C. Ellery; (June 1) T. A. Bax; A. W. Brown; M. L. Gauntlett; R. J. Kenworthy; C. B. Randall; J. B. G. Stratton; E. T. Wilcox; W. J. Winter; (June 12) D. M. A. Smythe; (June 15) J. F. H. Larden; G. W. Leonard; G. J. A. Lewis; L. T. Marks; D. S. Mims; A. Paterson; G. F. C. Pledger; W. A. Ponting; R. N. Ridley; G. Ryle; J. V. Silverston; F. A. Toombs; W. F. P. Webber; P. Byng-Hall; E. G. M. Bond; J. M. Bousfield; J. C. Bull; L. M. Blain; R. J. Candy; S. Carter; D. W. Chisholm; G. Cleveland; A. S. Collinson; S. B. De Mier; B. A. Z. De Bressey; G. R. M. Ford; G. H. Hannan; E. A. Hinxman; J. R. Hoppe; H. J. Jeffcoat; W. Jones.

The undermentioned Pilot Officers are promoted to the rank of Flying Officer on the dates stated:—(Nov. 3, 1939) C. N. Foxley Norris; (Dec. 3, 1939) A. W. N. Britton; (March 30) A. P. Pease; (May 1) D. K. C. O'Malley.

Balloon Branch.

The undermentioned are granted commissions for the duration of hostilities as Pilot Officers on probation with effect from the dates stated and with seniority of April 25:—Sergeant: (June 7) K. A. Southwell. Corporal: (June 6) R. W. Buck; Temporary Corporals: (June 6) F. G. W. Jackson; F. S. James. Aircraftman 1st Class: (June 7) C. G. Gerry. Aircraftman 2nd Class: (June 11) W. F. R. Dickinson.

Administrative and Special Duties Branch.

Capt. B. Hobson, M.B.E. (R.A.R.O.) is granted a commission as Flight Lieutenant with effect from June 15, and with seniority of July 31, 1939.

The undermentioned are granted commissions for the duration of hostilities as Pilot Officers on probation with effect from the dates stated and with seniority of April 25: Corporals: (May 30) A. E. Thompson; (June 10) S. Hathaway. Temporary Corporals: (May 27) E. F. Clennell; (June 10) J. Holland. Leading Aircraftmen: (June 1) W. R. Pearson; S. D. Stubbs; (June 7) G. H. Harley; (June 14) R. F. S. Patchin. Aircraftmen 1st Class: (June 10) S. K. Dunford; N. Vincent.

L.A./C. A. J. Ball is granted a commission for the duration of hostilities as Pilot Officer on probation with effect from June 7 and with seniority of May 30.

The undermentioned are granted commissions for the duration of hostilities as Pilot Officers on probation with effect from the dates stated:—(Oct. 10, 1939) C. J. Jenkins (substituted for notification in the *Gazette* of Nov. 28, 1939); (May 14) A. J. E. Behm; (May 19) W. J. C. Morgan; (May 29) W. N. Charnley; (May 31) G. S. Bosworth; E. Bromley-Davenport; J. I. I. David; W. H. Garnett; J. N. C. Law; T. C. Mills; C. W. K. Mundle; G. D. Pilkington; E. P. Salmon; K. M. Smith; W. H. Trickett; H. L. Wright; (June 1) C. S. Twist; F. A. W. Warne; (June 5) T. R. F. Brook; J. P. Ward; (June 6) J. G. Orange; R. S. V. Talbot, M.C.; (June 7) T. B. Bates; P. G. N. Booth; J. L. Burbidge; D. M. Cashmore; B. V. S. Charlton; G. E. B. Christie; G. Cockerham; H. W. M. Coley; R. P. G. Crickmer; E. A. Davies, Jun.; R. H. Davies; I. E. Dear; A. P. Dixon; J. K. Dudley; F. E. H. G. Gibbens; J. F. Goddard; F. H. G. Williams; E. H. Haines; E. A. D. Heath; H. G. Henderson; C. W. Hughes; W. H. Jones; I. C. I. Lamb; J. F. F. Platts-Mills; W. A. Radley; H. C. Rattle; C. W. Rippon; E. D. Smith; C. T. Theobald; K. S. Thompson; J. E. G. Utting; N. Washington; N. H. White; W. S. White; (June 8) S. A. Abbott; B. H. Bevan-Petman; P. A. Rockey; (June 10) G. W. Baxter; E. S. Comberbach; L. Harrison; T. Laidler; D. C. L. Love; L. Malec; N. J. Tufnell; H. J. K. Wallis, O.B.E.; (June 11) C. H. G. Millis; (June 12) L. A. Hooper; D. L. Howard, M.C.; J. E. Mann; H. A. B. Salmond; R. H. Warden; (June 13) A. Murray; G. H. Phillips; W. Slater; H. H. Storrs; L. Wood; (June 14) J. Appleton, M.C.; H. O. Brown; A. E. J. Burden, M.C.; F. W. Cram; W. J. Grace; A. E. Morgan; A. L. Murray; A. S. Newman; G. N. Prout; V. R. Waters; A. Wilson; (June 15) H. J. Downing; A. H. E. Frost; F. L. J. Rogerson; (June 17) J. McK. Anderson; P. E. Burrell; The Honourable Sir E. C. G. Cadogan, K.B.E., C.B.; N. Catt; K. L. Coghlan; A. R. Cooper; D. B. Davies; L. E. De Rouet; C. E. G. C. Emmott, M.P.; G. B. S. Fellows; G. W. Geldart; R. C. C. Green; M. Hackforth-Jones; R. B. Hamer; J. X. Hunt; J. E. Hunter; J. A. Hutton; Sir R. T. Leighton, Bt., T.D., D.L.; G. M. Kerr; A. L. S. O'Beirne; A. H. Ormerod; T. G. N. Pearce; A. P. Pitel; P. Pralle; C. W. P. Selby; R. H. Siddons; J. G. M. Simpson; F. A. Smith; D. Verschoyle; E. S. Vincer; A. A. V. Waterfield; F. Watkinson; C. C. Williams; S. C. Young.

C. N. Pollock is granted a commission for the duration of hostilities as Pilot Officer on probation for duty as Deputy Assistant Provost Marshal (June 10).

N. G. Bennett is granted an honorary commission as Flying Officer (June 25).

Pilot Officer on probation R. Landau is transferred to the General Duties Branch (May 20).

The undermentioned are transferred to the Technical Branch (April 24):—Group Captain: L. F. Blandy, C. B., D.S.O. Squadron Leader: J. R. Brown, D.F.C. Flight Lieutenant: F. N. McDowell. Flying Officers: C. H. Gardner; C. G. Phillips; D. H. Scott; W. N. Craig; R. Cook; A. J. Spiers; J. S. Dykes; I. O. Morton; S. G. Morgan; L. Norris; C. S. Goode; G. R. Scott-Farnie; F. A. Boyce; J. H. C. Hunter; H. Edge; C. L. Berrington; K. Jowers; C. L. A. Le Baron Whyte; C. H. Parsons; J. Scott-Taggart, M.C.; A. F. Trinder; W. G. M. Money; H. A. M. Whyte; J. W. A. Legge-Willis; H. C. Page; J. K. Hankinson; C. I. Orr-Ewing; C. H. Badderley; C. A. G. Quarrington; H. B. T. Childs; G. W. Adams; R. K. Budge; F. E. Everard; M. C. Evans; H. Barker, M.B.E.; H. B. Dent; J. C. Hosburn; C. A. Wilkin; L. W. Allen, M.C.; H. Dinwoodie, M.C.; E. Vredenburg; M. O. F. England; C. B. Millett; G. H. B. Richards; D. S. Richardson. Pilot Officers on probation: P. Allden; P. B. Scott; J. T. Lean; R. B. Galway; V. G. Hopkins; W. J. P. Sloan; S. H. White; F. W. Everill; D. Vale; F. T. Harris; J. E. Lonsdale; J. P. Lynas; H. W. R. Trigg; R. G. Goodfellow; J. R. Boundy; H. G. David; L. W. D. Pittendrigh; L. W. Brown; F. H. Babcock; J. T. Bain; E. C. Greaves; M. G. Scroggie; J. M. R. Sutton; H. Andrewes; S. F. Evans; A. M. Hardie; C. S. Jones; J. G. Ratcliffe; E. W. Braendle; J. H. Bruce; W. C. Fahie; E. M. Eldred; F. Ingham; J. C. Martin; N. Best; H. V. Pexton; W. D. A. Smith; H. L. Assig; V. Bowman-Burns; E. M. Hook; G. G. Livesey; F. A. Downes; A. E. Clarke, D.F.M.; M. L. D. Metcalfe; R. S. Page; C. Pidd; S. P. F. Humphreys-Owen; M. F. Comer; R. W. L. Palmer; W. J. Reason; A. E. L. Roylance; A. E. Dobson; C. F. W. Ball; J. O. Bate; L. T. Eden; E. F. O. Masters; A. F. Allen; H. F. Cowin; J. F. Mortimer; F. A. Kemp; H. J. Barton-Chapple; F. X. J. Armstrong; D. R. R. Fair; H. O. Newton; W. J. Foy; F. J. Meggs; N. Cave; D. H. Johnson; S. Jones; C. C. Newton-Wade; J. Ree; N. V. Webber; P. D. Walters; E. B. O'H. Bennett; I. Campbell-Bruce; H. Clarke; T. B. Thomson; B. M. J. Davis; R. F. Durrant, A.F.C.; E. J. Alway; C. J. Bayley; G. W. Tookey; N. F. Powell; J. H. Hunter-Tod; J. N. K. Whitford; R. H. Johns; H. C. Walmsley; W. M. Lanyon; C. P. J. Gilroy; J. Spinks; T. R. White; J. K. Rickard; R. C. Lawes; G. A. Chapman; R. C. Couzens; J. W. Davies; R. W. Armstrong; P. E.

The Air Defence Corps boasts a strength of no less than 23,000 boys. Most of them are already doing war work of some kind. Our photograph shows a group studying wireless operating.

Axon; G. S. Barham; C. A. Clark; D. P. Furneaux; J. E. Ives; R. D. Racine-Jaques; F. F. Wells; A. R. Enshaw; W. F. Taylor; A. E. Mitchell; W. A. Tarry; L. Cushion; B. V. Grealy; H. H. Hardy; R. E. Shaw.

P/O. A. E. Snape, O.B.E., resigns his commission. April 30.

Honorary Wing Cdr. R. Whiddington, M.A., D.S.C., F.R.S., relinquishes his honorary commission on ceasing to be employed as the Royal Air Force representative on Leeds University Joint Recruiting Board. May 24.

The undermentioned honorary Pilot Officers relinquish their honorary commissions on cessation of duty:—(July 1) A. T. M. Henniker; J. W. P. Martin; G. P. White.

Honorary Group Capt. F. L. Festing, C.M.G., relinquishes his honorary commission on account of ill-health. July 13.

F/O. G. H. Blair is removed from the Royal Air Force Volunteer Reserve (April 26).

The commissions of the undermentioned Pilot Officers on probation are terminated on cessation of duty on the dates stated.—(June 25) C. M. Gibson; (June 26) R. D. L. Humbert.

F/O. H. F. G. Waters is cashiered by sentence of General Court Martial (June 17).

Equipment Branch.

Shipwright Lieutenant E. J. Cole (R.N., Ret.) is granted a commission as Flight Lieutenant (June 19).

The undermentioned are granted commissions for the duration of hostilities in the ranks and on the dates stated:—Pilot Officers on probation: (June 1) J. R. Crook; F. de M. Culpin; J. Fearne; I. O. Fuller; (June 5) G. C. Laws; M. E. Longman. Acting Pilot Officers on probation: (June 1) F. A. L. Addison; W. A. S. Alexander; I. G. G. Ayscough; C. R. Baker; G. A. C. Baynes; A. R. Benbow; K. M. Bryan; S. W. Dalton; R. L. Davies; G. S. De Freitas; B. F. J. Dolman; H. C. Fairbrother; R. Follett; D. R. P. Foot; E. C. Gibbs; P. S. Gooda; H. J. D. Goodey; A. Grant; B. Green; E. D. Green; T. F. Griffin; V. Heaton; W. A. Howitt; R. A. Hyde; E. A. Inch; B. A. Johnston; A. C. Jones; G. J. Kellow; W. King J. C. Lindsay; G. E. Main; T. Mitchell; E. L. Murrell; G. W. Newman; W. J. Nicholas; J. A. Paul; H. F. Pelham; F. J. D. Pring; N. E. Radcliffe; H. U. C. Rhodes; W. T. R. Richman; K. A. N. Roberts; A. W. C. Sawyer; G. A. Smith; P. P. G. Smith; R. J. Smith; R. G. Spillane; W. W. Stabb; R. F. Strange; B. F. Trevelyan; W. G. Turnbull; D. A. Turner; J. P. Turtle; J. A. Twentyman; D. M. Tyringham; B. A. Van Zwanenberg; W. J. R. Warren; K. S. Wimbush; D. W. Withington; P. Yorke.

The undermentioned Acting Pilot Officers on probation are graded as Pilot Officers on Probation on the dates stated:—(May 13) J. W. Clegg; W. M. Lloyd; E. J. Morris; (May 20) R. E. H. Fender; R. G. G. Ponsonby.

The undermentioned Pilot Officers are promoted to the rank of Flying Officer on the dates stated:—(April 18) E. C. Paine; (April 25) T. W. C. Robinson; E. G. Cooper; (May 1) C. E. Plummer.

Accountant Branch.

S. E. Phillips is granted a commission for the duration of hostilities as Pilot Officer on probation. June 12.

Medical Branch.

The undermentioned are granted commissions for the duration of hostilities as Flying Officers:—(June 11) C. E. Astley, M.B., Ch.B.; R. O. Gillhespy, M.B., Ch.B.; P. R. B. Grimaldi, M.R.C.S., L.R.C.P.; K. N. Lloyd, M.B., B.S., M.R.C.S., L.R.C.P.; P. Murphy, M.B., B.Ch.; D. S. Pattison, L.R.C.P. and S.; A. M. Phillips, M.B., Ch.B.; D. B. Spence, M.R.C.S., L.R.C.P.; W. N. Watt, M.B., Ch.B.

Flt. Lt. T. Crowley, M.B., Ch.B., takes rank and precedence as if his appointment as Flight Lieutenant bore date November 30, 1939. Reduction to take effect from April 22.

F/O. A. MacK. Gunn, M.B., Ch.B., relinquishes his commission on account of ill-health. June 25.

Dental Branch.

The undermentioned are granted commissions for the duration of hostilities as Flying Officers:—(June 11) C. M. Beales, L.D.S.; H. P. Britten, L.D.S.; A. J. D. Gibbings, L.D.S.; W. B. Knapman, L.D.S.; N. A. McCormick, L.D.S.; W. A. T. Parsons, L.D.S.

Chaplains Branch.

The undermentioned are granted commissions for the duration of hostilities with the relative rank of Squadron Leader on the dates stated:—(May 27) The Rev. H. W. Langford-Sainsbury; (June 10) The Rev. P. Birkett, B.A.; The Rev. D. F. Chrissop; The Rev. N. A. F. Townend, B.A.; (June 12) The Rev. D. H. Saunders Davies, M.A.; (June 17) The Rev. H. G. Sellers; (June 19) The Rev. E. McC. Rule, M.A.

Auxiliary Air Force

General Duties Branch.

F/O. E. S. Williams is promoted to the rank of Flight Lieutenant. March 12.

P/O. J. B. Selway is promoted to the rank of Flying Officer. February 1. (Substituted for the notification in the Gazette of June 11.)

F/O. B. D. C. Wilkinson is transferred to the Administrative and Special Duties Branch. November 2, 1939.

Women's Auxiliary Air Force

The undermentioned are appointed Assistant Section Officers:—(June 22) Corporal Miss W. F. Ainslie; Aircraftwoman 2nd Class Mrs. M. D. V. Beard; Aircraftwoman 2nd Class Miss M. J. Beattie; Corporal Miss P. S. Curry; Aircraftwoman 1st Class Miss I. Davis; Corporal Miss B. M. Dowding; Sergeant Mrs. F. H. Duff; Aircraftwoman 2nd Class Miss M. H. Duncan; Aircraftwoman 1st Class Miss M. S. Filgate; Corporal Mrs. S. Gibbon; Aircraftwoman 2nd Class Miss B. J. Gray; Aircraftwoman 2nd Class Miss P. Hallsmith; Aircraftwoman 1st Class Miss P. Hathway Jones; Aircraftwoman 1st Class Miss S. D. E. Kettlewell; Sergeant Miss F. E. Knox-Gore; Aircraftwoman 1st Class Miss H. A. M. Mathews; Corporal Miss E. B. Milln; Corporal Miss R. S. Ross; Corporal Miss E. L. G. Stephenson; Aircraftwoman 2nd Class Miss G. Weston; Aircraftwoman Miss M. Wiltshire.

The undermentioned officers relinquish their appointments on the dates stated:—Flight Officer: (June 19) Miss W. R. H. Startin. Assistant Section Officers: (September 3, 1939) Miss V. E. Scott; (January 4) Mrs. J. M. Shepherd-Graham; (May 31) Mrs. H. M. D. Duff; (June 8) Mrs. N. B. K. Cochran-Patrick; (June 23) Mrs. M. Z. Pain.

Assistant Section Officer Lady H. A. Blunt relinquishes her appointment on ceasing to be employed. May 20.

Radiator Sealing Ring

ON several of the heavier types of aeroplane twin-radiators are fitted to each engine. On the front of these twin-radiators there is a raised flange, and on to this flange the cowling registers. A metal-to-metal contact must be avoided but an efficient weathering device provided. Whatever weathering is provided must, of course, be oil and petrol proof, owing to the close proximity to the engines.

For this purpose the Empire Rubber Company have designed a Radiator Sealing Ring of extruded rubber in a quality which is called "Craftpac." This is a tubing with two projections for fitting over the raised flange on the radiator by Bostick or other methods. It is oil and petrol resistant. In order to avoid too easy a collapsing of the tubular portion, a cured sponge cord is inserted into the tubular cavity, thus ensuring a good cushioning, but one which will not collapse.

Particulars as to prices and dimensions are to be had direct from the Empire Rubber Company, Dunstable, Beds, who specialise in supplying rubber goods to meet the requirements of any trade problem.

Birlec Heavy-service Furnaces

A NEW publication issued by Birmingham Electric Furnaces, Ltd., Erdington, Birmingham, 24, describes one of the most popular ranges of standard furnaces introduced by this firm. Known as the "Heavy Service" type, they are available in convenient sizes developed as a result of actual experience of production requirements. The chief features of these furnaces are the heavy section nickel-chromium resistors, beat into sinuous form and mounted on patented metal hook supports, and the means taken to provide and maintain uniform heat distribution throughout the furnace. To secure this the elements are so disposed as to heat the charge as uniformly as possible and the heat-output of the elements in various parts is regulated to compensate for heat losses. To neutralise losses near the opening a heating element is incorporated in the door, regulated by a patented control system by which the proportion of heat input from the door element is increased during "soaking" periods, thus maintaining a uniform temperature throughout the heating cycle.

The publication includes a brief specification of the structural features and illustrates some of the widely diversified applications of these heat-treatment furnaces. Free copies are obtainable from the address given above.

THE INDUSTRY

Rivet-salvaging Machine

IT costs less to let a rivet lie than to pay for the riveter's time to pick it up, but the Glenn L. Martin Company, of Baltimore, found that their cleaners were sweeping up some 60lb. of light metal parts, principally rivets, every day and that this represented a loss of about $60, which is about $15,000 per year. Not even putting a team of boys on sorting the swept-up rivets solved the problem, as their wages were found to be greater than the value of the rivets saved.

But the tool design office produced a machine designed to do the work automatically. The first process is to pass an electro-magnet over the floor sweepings and so remove all the steel parts. Next the rivets are put through a series of sieves which separate the various diameters, after which the rivets travel, heads up and shanks down, along an inclined track from the feeding hopper into teeth cut in the perimeter of a big wheel. A small fixed arm can be adjusted to knock off either the round-head or the countersunk type into a bin, while the remainder go through and "feel" with their shanks for the flaring springs below, which force them off the wheel into their proper bins. The long shank rivets fall first and the shortest last.

To save resorting those of different head shape which were knocked off the wheel, a small machine is available to do a preliminary sorting into head shapes only, and the rivets may be put through this before going to the larger length-sorting machine. This head sorter works at twice the speed of the length sorter, and can do 100lb. of five-thirty-secondth inch rivets in 8 hours. It is claimed that the expense of running these rivet sorters is small, and that of the $15,000 potential annual loss due to dropped rivets, $12,000 is recovered through the use of the machines. It is obvious that the principle could be applied in many industries using rivets, irrespective of their size.

When the tool design office was first presented with this problem they must have regarded it as nearly insoluble. But there is little that modern design cannot do.

NEW COMPANY

Harman Sirketi (London), Limited, was registered as a "private" company on June 7, with a nominal capital of £500 in 500 shares of £1 each. The objects are to acquire the interest of Mehmet Vedad Kent in the goodwill and undertaking throughout the British Empire of the Turkish company established in Istanbul and called Harman Sirketi there (where the said company is the agent, *inter alia*, for the British Power Boat Co., Ltd., the Fairey Aviation Co., Ltd., Denver Equipment Co., Ltd., Henry Hughes & Son, Ltd., Welin-Machlachlan Davits, Ltd., J. Stone & Co., Ltd., Day, Son & Hewitt, Ltd., General Aircraft, Ltd., and Goodlass Wall & Co., Ltd.) to act as importers and exporters of all kinds of goods, etc.

The directors are: Mehmet Vedad Kent, 80, Harley Street, W.1, merchant, and Noel J. Dodd, 18, Essex Street, W.C.2, chartered accountant.

No share qualification required. Solicitors: Norman Hart and Mitchell, 21, Panton Street, S.W.1. The registered office is 19, Berkeley Street, W.1.